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1985 RAPTOR RESEARCH FOUNDATION

SYMPOSIUM ON THE MANAGEMENT OF BIRDS OF PREY

INTERNATIONAL MEETING

Friday, November 1
Workshop: Status & Listing Needs of
Ferruginous & Swainson's Hawks



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* ABSTRACTS *

SESSION 1.

WORKSHOP: STATUS AND LISTING NEEDS OF FERRUGINOUS AND SWAINSON'S HAWKS

November 1, 1985
Sacramento, California

Hosted by:

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The National Audubon Society
Pacific Gas and Electric Company
The Peregrine Fund, Inc.
Southern California Edison Company
San Francisco Zoological Society
U.S. Fish and Wildlife Service
The Western Foundation of Vertebrate Zoology

Status of Ferruginous Hawk (Buteo regalis) nesting sites in Washington.

HARRIET L. ALLEN (Washington Department of Game, 708 40th Street N.W., Marysville, Washington 98270. Phone: 206-653-8290), Ron Friesz (Washington Department of Game, P.O. Box 1237, Ephrata, Washington 98823. Phone: 509-754-4624), and Richard E. Fitzner (Battelle Pacific Northwest Laboratory, P.O. Box 999, Richland, Washington 99352. Phone: 509-376-7179).

An inventory of Ferruginous Hawk nest sites was conducted in southeastern Washington during June-August 1981 to determine current status, land ownership, land-use practices, disturbance levels, and vulnerability to changes in land use or disturbance. A total of 62 nest territories were found: 28 were active, 3 were occupied, and 31 were inactive. Production was estimated to be 3.25 young per successful nest. Fifty-seven percent of the nest sites were on private land, 27% on Federal land, 7% on mixed Federal and private land, and 8% were undetermined. Eighty-two percent of the nest sites were in native steppe vegetation, and 16% were in cultivated lands. Of 41 sites evaluated in a Vulnerability Rating scheme, 70% were Vulnerable or Highly Vulnerable to future loss of habitat and/or increased human disturbance.

Nesting distribution of the Ferruginous Hawk in southern Idaho.

MARC J. BECHARD and Keleigh D. Hague (Department of Biology, Boise State University, 1910 University Drive, Boise, Idaho 83725. Phone: 208-385-3262).

The distribution of Ferruginous Hawk nests in southern Idaho was studied during the summer of 1985. Nest searches were conducted in areas where U.S. Bureau of Land Management (BLM) and Idaho Department of Fish and Game records showed active nests between 1975 and 1978. The majority of the 59 active nests found were within southeastern and southcentral Idaho. These nests were built primarily in juniper trees and were on or bordering BLM land. Fewer nests were in the southwestern portion of the state. Here, most nests were on cliffs and basalt outcrops adjacent to the Snake River.

Breeding status of the Swainson's Hawk in southeastern New Mexico.

JAMES C. BEDNARZ (Department of Biology, University of New Mexico, Albuquerque, New Mexico 87131) and Stephen W. Hoffman (Endangered Species Office, U.S. Fish and Wildlife Service, Albuquerque, New Mexico 87103).

Although the Swainson's Hawk is a common summer roadside hawk in the southwestern United States, very little information is available on its breeding status. In New Mexico between 1981 and 1985, the mean clutch size for Swainson's Hawks was 2.45 ($N = 60$). Fledging success was highest in 1981 and 1982 (mean = 1.91, $N = 22$) which corresponded with a period of high prey populations. Overall mean fledging success between 1981 and 1985 for the 72 nesting attempts monitored was 1.50. The primary prey was large insects, primarily orthoptera (35%; $N = 856$). Young cottontails, which comprised 17.1% of the prey in terms of numbers, contributed 80% of the biomass consumed by the hawks. Swainson's Hawk nesting density was 1.42 per 10 km², higher than any density reported in the literature. Based

on these data, we believe that the New Mexico Swainson's Hawk should not be listed as a threatened species at this time; however, management approaches should be implemented in order to maintain the species at its present status.

The status of the Swainson's Hawk (Buteo swainsonii) in California outside of the central valley.

PETER H. BLOOM (Predatory Bird Research Group, Lower Quarry, University of California, Santa Cruz, California 95064. Phone: 408-429-2466), Steven J. Hawks (U.S. Bureau of Land Management, Susanville District, P.O. Box 1090, Susanville, California 96103. Phone: 916-257-5381), Stewart W. Janes (Biology Department, University of California, Los Angeles, California 90024. Phone: 213-825-1327), Robert W. Risebrough (The Bodega Bay Institute, 2711 Piedmont Avenue, Berkeley, California 94705. Phone: 415-549-2476), and Brian Woodbridge (Humboldt Wildlife Research Group, P.O. Box 4141, Arcata, California 95521. Phone: 707-445-8509).

The Swainson's Hawk in California underwent a drastic decline between approximately 1940 and 1979. This study reports on the status of populations in northeast California, Sierra Nevada Mountains, Owens Valley, and southern California. Results indicate a substantial but decreasing population in northeast California, a small but stable population in the Sierra Nevada Mountains, a small but probably increasing population in the Owens Valley, and an almost completely extirpated species from the once large southern California population. Ecological studies in northeastern California have revealed a population with a highly variable reproductive performance, a strong preference for small mammals in the diet, a high degree of mate and territory fidelity, and short dispersal distances for young. Results from the analysis of addled eggs indicate that pesticides do not appear to be a major problem in this population.

Estimates of breeding population and density of Swainson's Hawks based on migration counts.

WILLIAM S. CLARK (9306 Arlington Blvd., Fairfax, Virginia 22030. Phone: 703-591-7778).

Smith counted an average of 322,000 Swainson's Hawks per year migrating through Panama in the autumn. Assuming that this is the species' total population and that one third (upper limit) or one fourth (lower limit) of these were breeding adults, then the calculated number of breeding pairs is 53,000 (upper limit) or 40,000 (lower limit). The total breeding area of this species was estimated for each State and Province where it breeds. Assuming an even breeding density throughout its range, the calculated densities are 41 (upper) and 31 (lower) pairs per 1,000 square miles. The calculated number of breeding pairs for each Province and State are presented based on the calculated density and the area suitable for Swainson's breeding. These are compared to densities and estimated population numbers in some areas based on field studies.

Summary of Swainson's Hawk status in the Great Plains states, including some midwest states.

WILLIAM S. CLARK (9306 Arlington Blvd., Fairfax, Virginia 22030. Phone: 703-591-7778).

Nongame personnel from states within the range of the Swainson's Hawk were contacted by telephone and asked several questions regarding the status of this species in their state. There was a general consensus among the personnel from the Great Plains states of Texas, Oklahoma, Kansas, Nebraska, and the Dakotas that this species is common and is experiencing no population difficulties. All further stated that their state was not conducting any surveys and that this species has not been given any special listing, such as "endangered," "special concern," etc. There are, however, no quantitative data to support these contentions except for a recent nest survey in North Dakota. Additionally, none of the states had any data or estimate of the total number of breeding pairs of this hawk. The Swainson's Hawk situation is viewed differently in several states just to the east of the Great Plains in Minnesota, Iowa, Wisconsin, and Illinois, where there are small peripheral breeding populations. Two states, Illinois and Iowa, have this species listed as "endangered" and "special concern," respectively. However, there were never more than a dozen pairs breeding historically in any of these states.

Literature survey of migrating and wintering Swainson's Hawks in Latin America.

ALLEN M. FISH (Raptor Migration Observatory, Golden Gate National Recreation Area, Bldg. 201, Fort Mason, San Francisco, California 94123. Phone: 415-331-5246).

During September and October 1985 I searched the literature for accounts of migrating and wintering Swainson's Hawks in Latin America. Having recovered over 40 references, I herein summarize reports of Buteo swainsonii in Mexico, Guatemala, Honduras, El Salvador, Nicaragua, Costa Rica, Panama, Columbia, Venezuela, Ecuador, Brazil, Peru, Bolivia, Uruguay, and Argentina.

Status of the Swainson's Hawk in Washington State.

RICHARD E. FITZNER (Battelle Pacific Northwest Laboratory, Box 999, Richland, Washington 99352. Phone: 509-376-7179), Ron Friesz (Washington Department of Game, P.O. Box 1237, Ephrata, Washington 98823. Phone: 509-754-4624), Jerry Hickman, Susan Tank, and George Brady (Washington Department of Game, 600 N. Capitol Way, Olympia, Washington 98504. Phone: 206-754-1449).

Survey data and LANDSAT imagery collected during the last decade is used to provide an estimate of the number of breeding pairs within certain habitat types.

Nest site selection, nesting success, and fledging success of the Ferruginous Hawk (Buteo regalis) in central North Dakota: a comparison of two studies.

RONALD C. GAINES (Zoology Department, North Dakota State University, Fargo, North Dakota 58105. Phone: 701-237-7087).

The nest site selection, nesting success, and fledging success of the Ferruginous Hawk were documented on a 1,259-sq-km study area of central North Dakota from 1977 to 1979 (see Gilmer and Stewart, J. Wildl. Manage. 4(1):1983) and from 1983 to 1985 (R.C. Gaines, unpubl.). The number of occupied nests located on the study area remained essentially unchanged between the two studies. A significant increase ($P < 0.01$) in the number of nests on power line towers and a significant decrease ($P < 0.01$) in the number of nests on the ground occurred between 1977-79 and 1983-85. The number of occupied nests in trees and on haystacks did not change significantly between the two studies. Mean nesting success for all nests decreased from 71.1% (1977-79) to 62.6% (1983-85). Mean fledging success for all occupied nests decreased from 2.2 (1977-79) to 1.6 (1983-85) young per occupied nest.

Status of the Ferruginous Hawk in Arizona.

RICHARD L. GLINSKI (Arizona Game and Fish Department, 2222 W Greenway, Phoenix, Arizona 85023. Phone: 602-684-3385).

There are presently no quantitative data that enable an accurate assessment of population trends for Arizona's Ferruginous Hawks. Approximately six nesting sites are known in the state, but adequate population and reproduction surveys have not been conducted. Potential causes of nest failure include disturbances of livestock operations and the illegal feather market. The recommendations of this report are to retain the Federal C-2 status of this species and to initiate a field survey that locates Ferruginous Hawks and closely monitors reproduction.

Status of the Swainson's Hawk in Arizona.

RICHARD L. GLINSKI (Arizona Game and Fish Department, 2222 W Greenway, Phoenix, Arizona 85023. Phone: 602-684-3385).

There are presently no quantitative data that enable an accurate assessment of population trends for Arizona's Swainson's Hawks. Migration counts are biased, because concentrations of Swainson's are affected by spatial arrangement of food resources. Nest counts are inadequate, because the cursory nature of past reproduction surveys precludes accurate assessment at the approximately 20 known nesting sites. Man-caused habitat alterations were the chief proximate causes of nest abandonment at a minimum of five sites. The recommendations of this report are to retain the Federal C-2 status of this species and to initiate a field survey that locates Swainson's Hawk nests in various grassland habitats of Arizona and closely monitors reproduction.

Preliminary status report and notes on the breeding biology of the Swainson's Hawk (Buteo swainsonii) in northwest Arizona.

ROBERT S. HALL (U.S. Bureau of Land Management, 2475 Beverly Avenue, Kingman, Arizona 86401. Phone: 602-757-3161).

The occurrence of nesting Swainson's Hawks in northwestern Arizona has been previously documented, but not in detail. This paper documents both successful and unsuccessful nesting efforts for this species. Discussion includes preliminary study results on hypothetical and verified prey items, nesting substrates, nest placement, and potential threats to the species and/or their habitats.

Preliminary status report and notes on the breeding biology of the Ferruginous Hawk (Buteo regalis) in northwest Arizona.

ROBERT S. HALL (U.S. Bureau of Land Management, 2475 Beverly Avenue, Kingman, Arizona 86401. Phone: 602-757-3161).

Presently, only one active Ferruginous Hawk nest is known to occur in Arizona. This paper discusses preliminary study results on hypothetical and verified prey items, nesting substrates, nest placement, and potential threats to the species and/or their habitats.

A review of organochlorine pesticide residues in Ferruginous Hawk eggs.

CHARLES J. HENNY (U.S. Fish and Wildlife Service, Patuxent Wildlife Research Center, 480 S.W. Airport Road, Corvallis, Oregon 97333. Phone: 503-754-4840).

Ten Ferruginous Hawk nests in northeast Oregon were studied from 1978 to 1980. Pesticide residues, eggshell thickness, and reproductive success from these nests will be reviewed. In addition, egg residues from other published studies in the Pacific Northwest and elsewhere will be discussed.

A review of organochlorine pesticide residues in Swainson's Hawk eggs.

CHARLES J. HENNY (U.S. Fish and Wildlife Service, Patuxent Wildlife Research Center, 480 S.W. Airport Road, Corvallis, Oregon 97333. Phone: 503-754-4840).

U.S. Fish and Wildlife Service research projects during the last 10 years in the Pacific Northwest resulted in the collecting of a sample egg from 35 Swainson's Hawk nests (Henny and Kaiser, 1979. Murrelet 60:2-5; Henny et al. 1984. Raptor Research 18:41-48). Pesticide residues, eggshell thickness, and reproductive success from these nests will be reviewed. In addition, egg residues from other published studies in the Pacific Northwest and elsewhere will be discussed.

Status of the Ferruginous Hawk (Buteo regalis) in Nevada.

GARY B. HERRON (Nevada Department of Wildlife, 1100 Valley Road, P.O. Box 10678, Reno, Nevada. Phone: 702-789-0547).

The major breeding populations of Ferruginous Hawks in Nevada occur on the east central side of the State. However, isolated nesting activity occurs statewide. Fixed-wing aerial surveys have proven to be an efficient method for locating nesting territories. In Nevada the Ferruginous Hawk prefers to nest in scattered juniper trees near the ecotone between juniper and desert shrub communities overlooking broad open valleys. White sage (Ceratoides lanata) communities and the associated native grasses and forbs also appear to be an essential habitat component. This vegetative community generally supports relatively high densities of rodents and lagomorphs. Due to the tendency of Ferruginous Hawks to construct numerous nests within relatively large areas, the delineation of nesting territories has been difficult to assess. Production data between 1977 and 1983 resulted in an average of 2.9 young fledged per successful site. Approximately 240 nesting territories have been identified, and it has been determined that Nevada's Ferruginous Hawk population is presently stable.

Status of the Swainson's Hawk (Buteo swainsonii) in Nevada.

GARY B. HERRON (Nevada Department of Wildlife, 1100 Valley Road, P.O. Box 10678, Reno, Nevada. Phone: 702-789-0547).

The majority of documented Swainson's Hawk nesting territories in Nevada have been in agricultural valleys in the northern third of the state. Nests have been in a variety of vegetation; however, the majority of nests are in cottonwood or elm trees. Recent surveys indicate that Nevada's Swainson's Hawk population is declining. Data gathered by Department of Wildlife biologists places this raptor in similar habitat but in far fewer numbers than those recorded by ornithologists between 1940 and 1960. An average of 72% of the traditional nesting territories checked during the last decade have been occupied by adult Swainson's Hawks. young were successfully fledged from 74% of the occupied sites. There were 1.3 young fledged per occupied site, and 2.2 young were fledged per successful nesting attempt. It is presently estimated that fewer than 150 pairs of Swainson's Hawks nest in Nevada.

Decline of the Ferruginous Hawk in Saskatchewan.

C. Stuart Houston (863 University Drive, Saskatoon, Saskatchewan, Canada S7N 0J8. Phone: 306-244-0742) and MARC J. BECHARD (Department of Biology, Boise State University, Boise, Idaho 83725. Phone: 208-385-3262).

Before the turn of the century, the Ferruginous Hawk nested throughout the northern Great Plains, and nests were reported as far north as southern Alberta and Saskatchewan and east as far as southwestern Manitoba and northeastern North Dakota. Today, this hawk has disappeared from much of its northern boundary, and it occupies other areas in diminished numbers. To trace its decline in Saskatchewan, we studied nest records left by explorers, oologists, and early settlers and compared them to records of currently active nest sites. We found that nearly 40% of the hawk's original range is no longer occupied. Another 40% in southcentral Saskatchewan is only sparsely occupied. The remaining 20% of the original

range near the Alberta and Montana borders contains most of the known active nests. These nests are built in trees on relic stands of prairie grassland. The decline of Ferruginous Hawks coincided with agricultural development in the province, and it may have resulted when plowing of native grassland decimated populations of their main prey, the Richardson's ground squirrel. Because of cattle damage to currently used trees, we concluded that the Ferruginous could continue to decline in the province if measures are not undertaken to increase the availability of suitable nest trees.

Competitive interactions among Swainson's and Red-tailed Hawks, with additional notes on the Ferruginous Hawk.

STEWART W. JANES (Biology Department, University of California, Los Angeles, California 90024. Phone: 213-825-1327).

Territorial interactions, diet, and habitat use suggest that Swainson's and Red-tailed Hawks are intense competitors. The primary habitat gradient partitioned by these species and the Ferruginous Hawk reflects a perch density gradient. These species all exhibit interspecific territoriality, and Swainson's Hawks regularly displace Red-tailed Hawks from portions of their territories (areas with moderate perch densities). However, Red-tailed Hawks preferentially retained habitat with outcrops and high perch densities. A second habitat gradient related to prey is also important. Swainson's Hawks tend to occupy habitat characterized by abundant and predictable prey populations. Recent habitat changes in the intermountain region of Western North America have favored Red-tailed Hawks at the expense of Swainson's Hawks.

Ferruginous Hawk nesting surveys in the Snake River Birds of Prey Area: implications for long-term monitoring.

MICHAEL N. KOCHERT, Karen Steenhof, and John Doremus (U.S. Bureau of Land Management, Boise District, 3948 Development Avenue, Boise, Idaho 83705. Phone: 208-334-9279).

Of 38 Ferruginous Hawk (Buteo regalis) nesting territories identified from 1975 to 1985, 13 to 23 were occupied yearly. In 1985 occupancy rates at territories used in 1976 suggested a 54% population decline, but the 1985 nesting population actually increased 77% from 1976. All territories were vacant for at least 2 years of the 11-year study, and most were occupied 3 years or less. Mean number of young fledged per occupied territory per year ranged from 0.3 to 2.4 and was correlated with Spermophilus density, but not Lepus abundance. Number of occupied territories was not positively correlated with either squirrel or rabbit abundance. Data suggest that intra-area shifts of occupied nesting territories occur, and surveys of only formerly occupied territories may not be adequate to determine population trends. All nesting habitat within large areas should be completely surveyed.

Status of the breeding population of the Swainson's Hawk in Nebraska.

ROSS A. LOCK (Nebraska Game and Parks Commission, 2200 North 33rd Street, P.O. Box 30370, Lincoln, Nebraska 68503).

Analysis of breeding records from the years 1891 to 1985 indicates a reduction in range. The breeding population apparently was distributed statewide prior to major settlement and significant land use changes. Records compiled from 1891 to 1963 indicated nesting in 16 counties scattered throughout the state. As the result of large tracts of native grassland being converted to cropland, primarily in the eastern one-fourth of the state, the breeding range has been reduced and restricted to remaining grasslands in the western three-fourths of the state. Since 1963 breeding records are known from 13 counties in the north central, central, and portions of the south central areas of the state. There has been no documentation of breeding since 1963 in 10 eastern counties where nesting occurred prior to 1963 or in any other counties in the eastern one-fourth of the state. Although the historic breeding range has been reduced in size by approximately 25-35 percent, there are no indications that the current breeding population is threatened or endangered. Extensive grasslands suitable for nesting still remain, and their status is basically stable. Accounts of nesting are persistent from year to year, occurring not only in the same counties, but often in the same territory or nest tree. The number of known nest sites undoubtedly represents only a small portion of Nebraska's total breeding population. No concerted effort has been made to systematically locate occupied breeding territories or to evaluate reproductive success.

Distribution and status of nesting Ferruginous Hawks in Colorado.

J. MICHAEL LOCKHART (U.S. Fish and Wildlife Service, 529 25 1/2 Road, Suite B-113, Grand Junction, Colorado 81505) and Gerald R. Craig (Colorado Division of Wildlife, 317 West Prospect, Fort Collins, Colorado 80526).

Scattered populations of nesting Ferruginous Hawks are found throughout portions of Colorado's eastern plains and western desert basins. In eastern Colorado several Ferruginous Hawk investigations on site-specific study areas were initiated in the 1970's. Studies on the nesting status of Ferruginous Hawks in much of western Colorado began in 1981 and will continue through 1988. In this paper we attempt to summarize existing information on the distribution, size, and stability of local nesting populations of Ferruginous Hawks throughout Colorado. Basic survey methods, data deficiencies, and potential human related population threats are also discussed.

Distribution and status of the Swainson's Hawk in Colorado.

J. MICHAEL LOCKHART (U.S. Fish and Wildlife Service, 529 25 1/2 Road, Suite B-113, Grand Junction, Colorado 81505).

Although Swainson's Hawks are considered common in portions of Colorado, there are very few data on the distribution and overall abundance of this species. This paper summarizes existing data on local Swainson's Hawk populations found in Colorado. Data needs, habitat importance, and factors potentially affecting population levels are also discussed.

Ferruginous Hawk (Buteo regalis) distribution and nest site characteristics in south central Wyoming.

BRAD B. NELSON (U.S. Bureau of Land Management (BLM), Rawlins, Wyoming 82301. Phone: 307-324-7171), A. Jack Welch (BLM, Lander Wyoming 82520. Phone: 307-332-7822), and Carole Jorgenson (BLM, Rawlins, Wyoming 82301. Phone: 307-324-4841).

Since 1978 U.S. Bureau of Land Management biologists have been inventorying and monitoring Ferruginous Hawk (Buteo regalis) nests in south central Wyoming. Information is reported on more than 700 nests. Nest substrate, height of substrate, height of nest above ground, exposure, elevation, and number of eggs or young were recorded.

Swainson's Hawk (Buteo swainsonii) distribution and nest site characteristics in south central Wyoming.

BRAD B. NELSON (U.S. Bureau of Land Management (BLM), Rawlins, Wyoming 82301. Phone: 307-324-7171), A. Jack Welch (BLM, Lander Wyoming 82520. Phone: 307-332-7822), and Carole Jorgenson (BLM, Rawlins, Wyoming 82301. Phone: 307-324-4841).

Since 1978 U.S. Bureau of Land Management biologists have been inventorying and monitoring Swainson's Hawk (Buteo swainsonii) nests in south central Wyoming. Data were recorded for about 100 nests, including nest substrate, height of substrate, height of nest above ground, exposure, elevation, and number of eggs or young. Although search efforts varied each year, some nests were monitored every year.

Grasshopper related flocking behavior in the Swainson's Hawk.

LUCY NICKERSON, Christine Johnson, and Marc J. Bechard (Department of Biology, Boise State University, Boise, Idaho 83725. Phone: 208-385-3262).

During June 1985 large flocks of Swainson's Hawks were reported in Saskatchewan and Idaho. These flocks, which consisted primarily of immature birds, were found in areas of high grasshopper infestations. This paper reports daily observations on a flock of as many as 200 birds in southern Idaho. Casting analysis showed that grasshoppers were the major dietary item of the flock, with individual birds consuming an average of 99 grasshoppers per day. We suggest that grasshopper outbreaks may be of greater importance for Swainson's Hawks, particularly immatures, than was previously thought.

Ferruginous Hawk status in Wyoming.

ROBERT J. OAKLEAF (Wyoming Game and Fish Department, 260 Buena Vista Drive, Lander, Wyoming 82520. Phone: 307-332-2688).

The breeding distribution of Ferruginous Hawks in Wyoming is statewide, excluding mountainous areas. Raptor surveys and incidental reports have documented 483 nesting locations of the species. Estimates by latitude and longitude of Ferruginous Hawk survey intensity and findings show that there is a statewide population that certainly exceeds 800 nesting pairs.

Nesting densities of seven studies in Wyoming varied from one pair per 6,060 km² to one pair per 14.1 km². Three studies provided production data. Production varied from 1.07 young to 1.3 young fledged per nesting attempt. Widescale energy development has occurred and will continue throughout Ferruginous Hawk nesting habitat. Therefore, studies to document population trends are being proposed.

Swainson's Hawk status in Wyoming.

ROBERT J. OAKLEAF (Wyoming Game and Fish Department, 260 Buena Vista Drive, Lander, Wyoming 82520. Phone: 307-332-2688).

Swainson's Hawks historically and currently are considered common in Wyoming. Although nesting occurs statewide, the species appears to be most abundant in the southeast and northwest portions. Data are primarily limited to incidental observations and two localized studies. However, data are adequate to indicate that the species is not in need of special management attention in Wyoming.

Status of the Swainson's Hawk in southern Idaho.

DUANE H. PORTER, Keleigh D. Hague, and Marc J. Bechard (Department of Biology, Boise State University, Boise, Idaho 83725. Phone: 208-385-3262).

Records of historically active nest sites of the Swainson's Hawk in southern Idaho were compared to records obtained through a nesting survey conducted during the summer of 1985. The small number of historical records prevented a quantitative comparison, but it did indicate that the Swainson's Hawk has traditionally nested throughout the shrub-steppe region of southern Idaho in willows and junipers growing along creeks and on hillsides. The 1985 survey showed that the hawk continues to be a common nester, with nests occurring mostly in cottonwood and juniper trees growing on private land bordering land administered by the U.S. Bureau of Land Management. Current nest territories consist mainly of alfalfa fields which support large populations of either Columbian or Townsend's ground squirrels. Indications are that the Swainson's Hawk has not declined significantly since the state was first settled. However, its nests may have been redistributed in areas of intensive agriculture where nest trees and prey have become more plentiful.

Status of Ferruginous Hawks in western Kansas.

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A population of Ferruginous Hawks was studied during the breeding seasons of 1979 to 1985 in western Kansas. The majority of hawks in this study area nest on chalk buttes and ledges in areas of greater than 50% rangeland. Nesting activity was monitored in 65 nesting areas each season. The maximum number of pairs attempting to breed (57) occurred in 1979 and the minimum (24) in 1985. On average, 36 of the nest sites were active

per year. Pairs laid an average of 2.8 eggs, which resulted in 2.2 1- to 14-day-old young, and 1.9 15- to 26-day-old young. Nesting success varied from a high in 1979 (\bar{x} clutch = 3.44, \bar{x} young nestlings = 2.88, \bar{x} old nestlings = 2.53) to a low in 1984 (\bar{x} clutch = 2.44, \bar{x} young nestlings = 1.84) and 1981 (\bar{x} old nestlings = 1.33). Human disturbance of nesting areas (oil drilling, quarrying, fossil hunting, construction, etc.), spring hail storms, and nesting substrate natural breakdown were the major presumed sources of nesting failure. Predation was of lesser importance. These factors had significantly different impacts on nesting activity. Hawks only nested in 47% of sites previously disturbed by human activities, but reused 81% of sites naturally disturbed. Nesting activity was not observed at sites for an average of 2.5 years following human disturbance, 2.0 years following predation, and 1.3 years following losses due either to storms or substrate breakdown. Nest locations within nesting areas were moved an average of 1 km following either human disturbance or predation and 0.3 km following storms or substrate breakdown. Nesting activity and production at active nests during our years of study are therefore best described as declining. Increasing human activity near nest sites and the lasting influence this has on nest site usage appears to be a major factor associated with this decline.

Determining the breeding status of the Swainson's Hawk in the Central Valley of California.

RONALD W. SCHLORFF (California Department of Fish and Game, 1416 North Street, Sacramento, California 95814. Phone: 916-322-1261).

Breeding populations of Swainson's Hawks (Buteo swainsonii) have declined throughout California. The range, which once included much of lowland California, is now confined to portions of the Central Valley and a few northern and northeastern counties. The cause of the decline is not completely known, but its magnitude is estimated to be over 90%. Habitat destruction on both the breeding and wintering ground in South America must certainly have contributed to the decline. In the Central Valley, expansion of certain kinds of agriculture and loss of riparian vegetation have reduced foraging and nesting habitats. Where suitable riparian habitat and forms of agriculture compatible with the needs of the Swainson's Hawk exist, relatively dense populations remain in the Central Valley. However, overall, the density is very low. Also, the continued existence of habitats now supporting populations of Swainson's is in doubt, because of further agricultural expansion and loss of riparian habitat. Monitoring of Swainson's Hawk populations and habitat trend has occurred since 1979 when it was estimated that 280 pairs bred in the Central Valley. Intensive surveys of riparian habitats and certain agricultural areas indicate small but stable populations during the period 1981-85. Further monitoring at these study areas may reveal long-term population trends in the Central Valley.

Distribution, reproduction, and survival of Ferruginous Hawks in Alberta.

JOSEF K. SCHMUTZ (Department of Biology, University of Saskatchewan, Saskatoon, Canada S7N 0W0. Phone: 306-966-4412).

Ferruginous Hawks in Alberta occupy a breeding range which is reduced to 60% of the range formerly occupied by this species. These hawks nest at lower densities in areas where soil cultivation predominates over grazing. Trees at abandoned farmsteads are important in providing nest substrates which when absent frequently limit the size of the breeding population. The rate of reproduction in Ferruginous Hawks is high and has changed little during 6 of the past 11 years on a 480-km² study area. Of a total of 292 nests, 71% of pairs fledged 2.8 young on average. The breeding population size has remained remarkably stable, deviating by a mere 8% from a mean density of one pair per 9.4 km². Of 13 colormarked breeders, 77% survived to the following year.

Distribution, reproduction, and survival of Swainson's Hawks in southeastern Alberta.

JOSEF K. SCHMUTZ (Department of Biology, University of Saskatchewan, Saskatoon, Canada S7N 0W0. Phone: 306-966-4412).

In Alberta, Swainson's Hawks occupy prairie and parkland habitat, reaching their highest nesting densities at the ecotone between these biomes. These hawks are more abundant in areas of moderate cultivation than in pure grassland even when extra nest sites are available. Swainson's Hawks varied in nesting density on 87 randomly selected 41-km² plots between 0-14 pairs per plot. On a 480-km² study area Swainson's Hawk abundance has changed little during 6 of the past 11 years. The maximum deviation from mean density (one pair per 6.6 km²) was 23% with the greatest density achieved in 1985. Of a total of 439 nests, 74% of pairs fledged 2.0 young on average. Color-banded adults exhibited a greater degree of philopatry than did young. Of 28 adult hawks, 75% survived to the following year.

Banding and specimen records for the Swainson's Hawk from the nonbreeding season in Middle and South America.

STANLEY E. SENNER (Hawk Mountain Sanctuary Association, Rt. 2, Kempton, Pennsylvania 19529. Phone: 215-756-6961).

Most Swainson's Hawks (Buteo swainsonii) migrate through Middle and northern South America to spend the nonbreeding season in southern South America. Very little is known about their status and ecology en route or on their wintering grounds. In this report I review the distribution of Swainson's Hawks south of the United States based on banding and specimen data. These data are specifically discussed with reference to possible changes in this species' status, ecology, and winter range as the result of changing land-use practices in Middle and South America.

Density, annual production, and nesting habitat use of Swainson's Hawks in Strawberry Valley, Utah.

DENNIS L. SHIRLEY (Utah Division of Wildlife Resources, 1115 N. Main, Springville, Utah 84663. Phone: 801-489-5678).

The density, annual production, and nesting habitat of the Swainson's Hawk (Buteo swainsonii) were studied during 1982-1985 on a 68-square-mile area in Strawberry Valley, Utah. Density was found to be high, with 42 territories located. Based on a density of 61.8 nesting pairs per 100 square miles, Strawberry Valley has the densest known nesting population of Swainson's Hawks. Annual production has decreased since 1982 when 2.03 young fledged per active nest compared to 1.38 young in 1985. The mean number of nestlings fledged per successful nest was 2.0 (range = 1-4). Nest trees were all aspen (Populus tremuloides) averaging 35.4 feet in height. Nest trees were usually live, in relatively small aspen groves, near the stand edge. Many nest trees were supported by an additional leaning tree. The raptor population's principal prey item is the Uinta ground squirrel (Citellus armatus), and its decline is believed to be the main reason for the raptor production decline during the study period. The major long-range threat to the Swainson's Hawk population in Strawberry Valley is the increased human interference brought about by developing the valley.

Nesting ecology of the Ferruginous Hawk on a western Colorado/eastern Utah study area.

Mark V. Stalmaster (ERO Resources Corporation, 2801 Youngfield, Suite 121, Golden, Colorado 80401) and J. MICHAEL LOCKHART (U.S. Fish and Wildlife Service, 529 25 1/2 Road, Suite B-113, Grand Junction, Colorado 81805).

The distribution, status, and effects of human disturbance on a nesting population of Ferruginous Hawks was studied from 1981 through 1985. In this paper we summarize population changes in response to both man-caused and environmental factors. Although the number of nesting pairs remained relatively stable over the course of the study to date, productivity fluctuated drastically. Nesting success was strongly correlated with prey availability. Effects of human activities on Ferruginous Hawk nesting success was negligible and was more than compensated for by successful mitigation of nest site habitat losses.

Swainson's Hawk (Buteo swainsonii) nest survey: Adams County, Washington, 1983.

SUSAN L. TANK (Washington Department of Game, 600 N. Capitol Way, Olympia, Washington 98504. Phone: 206-754-1449) and Ron Friesz (Washington Department of Game, Ephrata, Washington 98823. Phone: 509-754-4624)

A Swainson's Hawk nest survey was conducted in eastern Adams County, Washington, between May 10 and June 24, 1983. The objectives of the survey were to describe characteristics of the nest sites; identify land use, ownership, and disturbance factors; and of primary concern, assess the condition of the nest trees. A total of 50 nests were located. Sixty-six percent of the nest trees were alive and healthy. An estimated 92% were on private property, and 98% were on land currently being farmed

or grazed. Nearly all the nests were easily accessible by foot or vehicle, and only 8% did not appear to be subject to any type of disturbance. Many of the tree species utilized by Swainson's Hawks are not being replaced by younger trees. With a reduction in available nest sites and with competition from other species for a limited resource, the Swainson's Hawk population in this part of Washington may face a decline in the foreseeable future.

Status of Ferruginous Hawks (Buteo regalis) in southeast Oregon.

STEVEN P. THOMPSON (Stillwater Wildlife Management Area, P.O. Box 1236, Fallon, Nevada 89406. Phone 702-423-5128), Carroll D. Littlefield (Malheur National Wildlife Refuge, P.O. Box 245, Princeton, Oregon 97721. Phone: 503-493-2323), and Richard S. Johnstone (1415 Dove Lane, Yreka, California 96097. Phone: 916-842-1395).

Ferruginous Hawks have been rare nesters and migrants in the Malheur-Harney Lakes Basin since at least 1874. They are the least common nesting Buteo in the basin. We confirmed only 13 active nesting sites between 1976-1982. There are no recent nesting records for Malheur National Wildlife Refuge. We review road transects, nest searches, productivity records, and the historic literature for this species.

Status of Swainson's Hawks (Buteo swainsonii) in southeast Oregon.

STEVEN P. THOMPSON (Stillwater Wildlife Management Area, P.O. Box 1236, Fallon, Nevada 89406. Phone 702-423-5128), Carroll D. Littlefield (Malheur National Wildlife Refuge, P.O. Box 245, Princeton, Oregon 97721. Phone: 503-493-2323), Richard S. Johnstone (1415 Dove Lane, Yreka, California 96097. Phone: 916-842-1395), and David G. Paullin (Malheur National Wildlife Refuge, P.O. Box 245, Princeton, Oregon 97721. Phone: 503-493-2323).

Swainson's Hawk populations have declined in southeast Oregon. From 1874-1935 they were the most numerous nesting and migrating Buteo in Harney County. The species was common on Malheur National Wildlife Refuge until the 1940s. A steady decline in both nesting and migrating birds began in the 1950s. The last nesting attempt on the refuge failed in 1979. A few pairs, possibly 18, do nest on adjacent BLM and private rangeland in western juniper (Juniperus occidentalis). We review quarterly road transects, nest records, and historic literature for Swainson's Hawks in southeast Oregon.

Status of a breeding population of the Ferruginous Hawk in central Utah: an 18-year summary.

NEIL D. WOFFINDEN (210 E&S Bldg., University of Pittsburgh, Johnstown, Pennsylvania 15904. Phone: 814-266-9661) and Joseph R. Murphy (M.L. Bean Museum, Brigham Young University, Provo, Utah 84602).

We have studied a west-central Utah Ferruginous Hawk population (Buteo regalis) from 1967 to present. During the 1972-74, 1980, and 1984 nesting seasons a comparison of hawk production and jackrabbit numbers was made, and nesting territories were routinely visited. With the exception of 1967-1968, field work has been less intensive during the remaining years. In 1967 thirteen nesting pairs fledged eight young. The following year 14 pairs produced 28 young. Production remained high through 1972 when 31 young were fledged from 16 occupied territories. Jackrabbits were abundant in 1972 but declined prior to the 1973 nesting season. The hawks responded classically to the drop in numbers of their major prey species with seven pairs fledging seven young in 1973. Only three fledglings were produced from seven occupied territories during 1974. Even though prey numbers again peaked in 1980, only five of the sixteen 1972 sites were occupied. Four nesting pairs fledged eleven young for an average of 2.75 young/pair. A new nest was found during the 1980 nesting season and is included in the production figures previously stated. Although 1980 nesting production was comparable to other high prey years, the Ferruginous Hawk population was down by 21 birds from the 1972 peak. Jackrabbit numbers declined again prior to the 1984 season when an intensive search was once again conducted. None of the traditional territories fledged young in 1984, although three adults were sighted in separate portions of the study area. Two territories were occupied in 1985 and may have fledged young. The Cedar Valley Ferruginous Hawk breeding population has declined significantly during the past 18 years. As expected, hawk numbers declined with jackrabbit populations, but subsequently failed to increase in tandem with the prey. Possible explanations will be discussed.

1985 RAPTOR RESEARCH FOUNDATION
SYMPOSIUM ON THE MANAGEMENT OF BIRDS OF PREY
INTERNATIONAL MEETING

Saturday, November 2 and Sunday, November 3
Symposium on Raptor Rehabilitation and Captive Breeding



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Exhibiting Old World vultures *****

Lucas Aubrey and NANCY CLARK * ABSTRACTS *
California 92085. Phone: 619 *****

The exhibition of plumed Old World vultures is a large, open enclosure is a relatively new concept in captive vulture management. The San Diego Wild Animal Park recently added two species of Old World vultures to their animal collection. Gypswill's Vulture (*Gyps gypswillii*) and African White-headed Vulture (*Gyps africanus*) are now being exhibited in a spacious, 120-acre enclosure. Sharing this enclosure with the vultures are various West African hoofed animals. Sharing this enclosure with the vultures are various West African hoofed animals.

SESSION 2.

SYMPOSIUM ON RAPTOR REHABILITATION AND CAPTIVE BREEDING

November 2-3, 1985
Sacramento, California

Hosted by:

The San Francisco Zoological Society

Accumulated exposure to environmental stressors and chemical exposures was collected on the day of hatching from 10 artificially incubated California Condors. Samples were homogenized with acetate buffer (pH 7), incubated overnight at 5°C, and stored frozen prior to hydrolysis. Beta-glucuronidase/arylsulfatase (Boehringer-Mannheim preparation, 0.05 U/ml, 0.05 M Tris-HCl, 0.05 M NaCl, 0.05 M NaH₂PO₄, 0.05 M NaOH, 0.05 M Na₂CO₃) was used for overnight hydrolysis, followed by extraction with 100% methanol. After super-

Held in conjunction with the 1985 Raptor Research Foundation Symposium on the Management of Birds of Prey, International Meeting by a non-profit organization. Condors, eagles, and other uncharacterized raptor species were measured. Total estradiol and estradiol levels were higher in females than males and indicated sex in all cases. Application of GC analysis as a non-invasive which sexing method will be discussed.

Sponsored by:

Individual recognition of American kestrels by tarsal scale patterns.

DAVID M. BIRD, Bureau of Land Management and Daniel Garrison (Macdonald Raptor Center) California Department of Fish and Game
California Energy Commission
Hawk Mountain Sanctuary Association

Institute for Wildlife Studies
The National Audubon Society
Pacific Gas and Electric Company
The Peregrine Fund, Inc.

Southern California Edison Company
San Francisco Zoological Society
U.S. Fish and Wildlife Service
The Western Foundation of Vertebrate Zoology

Exhibiting Old World vultures in a large, open enclosure.

Lance Aubrey and NANCY CLARK (San Diego Wild Animal Park, San Pasqual, California 92025. Phone: 619-747-8702).

The exhibition of pinioned Old World vultures in a large, open enclosure is a relatively new concept in captive vulture management. The San Diego Wild Animal Park recently added two species of Old World vultures to their animal collection. Ruppell's Vultures (Gyps ruppellii) and African White-backed Vultures (Gyps africanus) are now being exhibited in a spacious, 120-acre enclosure. Sharing this enclosure with the vultures are various East African hoofstock and bird species. Some of the obstacles that had to be overcome were: escapes, trauma by cagemates, and competition for food. Pinioned vultures have proven to be capable of gliding into the next enclosure when the wind is favorable. Providing suitable roosting sites was another challenge which was met by relocating a large tree snag to a knoll in the highest point of the enclosure. As these vultures mature, pair formation and nesting structures will be future considerations.

Profile and preliminary significance of egg waste estrogens (EWE) analyzed from day-old California Condors (Gymnogyps californianus).

ARDEN BRYAN BERCOVITZ (San Diego Zoo Research Department, P.O. Box 551, San Diego, California 92112. Phone: 619-231-1515 Ext. 450).

Accumulated excrement (allantoic urates and cloacal expressions) was collected on the day of hatching from 10 artificially incubated California Condors. Samples were homogenized with acetate buffer (pH 5), incubated overnight at 5°C, and stored frozen prior to hydrolysis. Beta-glucuronidase/aryl-sulfatase (Helix pomatia preparation, 0.05 ml/1.0 ml homogenate, 37°C incubation for 24 h) was used for enzymatic hydrolysis, followed by anhydrous diethyl ether extraction. Ether supernates were decanted, dried, and resuspended in 0.05 ml methanol for high performance liquid chromatography to isolate individual components analyzed by a nonspecific estrogen radioimmunoassay. Estrone, estradiol, and other uncharacterized polar estrogenic substances were measurable. Total estrogens and estradiol levels were higher in females than males and indicated sex in all chicks. Application of EWE analysis as a noninvasive chick sexing method will be discussed.

Individual recognition of American Kestrels by tarsal scale patterns.

DAVID M. BIRD, Sandra Wagner, Jeff Stewart, and Daniel Carriere (Macdonald Raptor Research Centre of McGill University, 21,111 Lakeshore Rd., Ste. Anne de Bellevue, Quebec H9X 1C0, Canada. Phone: 514-457-2000).

A heightened increase in the captive breeding of birds of prey for recreational and commercial purposes has led to the establishment of government regulations and hence, a need for a soundproof method to identify captive specimens individually. With the success of fingerprinting in humans and muzzle prints in canine and bovine species, the feasibility of using tarsal scale patterns was investigated with the help of a large captive colony of pedigreed American Kestrels (Falco sparverius). In 1980, the ventral tarsal scale patterns of 40 randomly selected Kestrels were photographed and examined. No two were remotely

alike. No resemblances were seen in three sets of siblings, as well as three parent-offspring combinations. In two trials involving 25 people each time, 21 of 25 and 24 of 25, respectively correctly matched a mystery tarsal photo from a batch of 20.

Radiotherapy: a cure for bumblefoot in raptors.

DAVID M. BIRD (MacDonald Raptor Research Centre of McGill University, 21,111 Lakeshore Rd., Ste. Anne de Bellevue, Quebec H9X 1C0, Canada. Phone: 514-457-2000) and Ted Roman (Jewish General Hospital, 3755, Chemin de la Cote de Ste. Catherine, Montreal, Quebec, Canada).

Initial successes with treatment of bumblefoot in captive birds of prey by irradiating the infected region with localized discharges of X-ray have led to further experimentation. The treatment generally consists of three hospital visits per bird during which the infected foot is irradiated with about 400 Rads for roughly one minute. Of ten birds tested, including Rough-Legged Hawks (Buteo lagopus), Red-tailed Hawks (B. jamaicensis), and Peregrine Falcons (Falco peregrinus), the treatment permanently cured eight. The two failures were chronic cases with eventual recurrence of the disease leading to euthanasia. Risk of sterilization is minimized by use of lead shields over the gonadal region. Two Peregrine Falcons successfully reared young the spring following treatment.

Pre-freeze and post-thaw effects of dimethylacetamide and glycerol on the morphology, motility, and fertilizing capacity of spermatozoa of the American Kestrel.

M. Kelly Brock and DAVID M. BIRD (MacDonald Raptor Research Centre, 21,111 Lakeshore Rd., Ste. Anne de Bellevue, Quebec, H9X 1C0, Canada. Phone: 514-457-2000, Ext. 345).

Kestrel spermatozoa, fixed in 1% glutaraldehyde and stained with fast green FCF, were examined using light microscopy. Spermatozoa frozen-thawed with glycerol showed a significant increase in size. Unlike glycerol, dilution with DMA had no effect on acrosome integrity. However, during freezing, DMA offered slightly better protection. Motility was suppressed by both compounds after dilution, with further reductions post-thaw. However, a greater percent of cells remained viable with glycerol. Semen with glycerol, before and after freezing, yielded the lowest fertility, while fresh semen and that diluted with DMA yielded the highest. Semen with DMA, post-thaw, yielded an intermediate fertility rate. Overall, DMA was more effective in preventing acrosome damage than glycerol, while glycerol was more effective than DMA in preventing motility loss in estral spermatozoa.

Forms and record keeping in raptor rehabilitation.

RICHARD D. BROWN (Carolina Raptor Center, Inc., P.O. Box 16443, Charlotte, North Carolina 28297-6443. Phone: 704-875-6521 or in USA 1-800/CALL-OWL).

No one likes paperwork and keeping records, but they are as essential in raptor rehabilitation as in business. Form and protocol design are time consuming processes in themselves. The Carolina Raptor Center

has developed a series of forms and record keeping procedures that have worked very well for us. Upon arrival, each bird is acquisitioned as either "Dead On Arrival," "Euthanized On Arrival," "Nonreleasable," or "Rehabilitation." Records for each bird are kept on a series of forms. The person bringing a bird in is asked to fill out the "Admission and History" form. The bird is given a thorough examination which is recorded on the "Exam and Diagnosis" form. The E&D form is designed to aid in the examination. Daily records are kept on a "Care and Treatment" form. The "Resolution" form also serves as the summary form. Different forms are color-coded for ease of location, and each form is given a page number. Rehabilitation staff are required to submit a "Daily Activity Report." The public is notified of the receipt and status of the bird by use of a postcard. Samples of each form will be made available.

The Andean Condor as a research surrogate for the California Condor.

James W. Carpenter, F. Joshua Dein, and DAVID H. ELLIS (Patuxent Wildlife Research Center, U.S. Fish and Wildlife Service, Laurel, Maryland 20708. Phone: 301-498-0494).

Captive propagation of Andean Condors (Vultur gryphus) was initiated at the Patuxent Wildlife Research Center in 1966 in anticipation of the need to apply resulting techniques to the captive breeding of the endangered California Condor (Gymnogyps californianus). This report summarizes the progress made on this Andean Condor breeding and research project, with emphasis on recent fostering/cross-fostering studies. These studies include: (a) fostering eggs/chicks between Andean Condors; (b) fostering of two chicks each to Andean Condor pairs; (c) cross-fostering of a Turkey Vulture (Cathartes aura) to Andean Condors; and (d) cross-fostering an Andean Condor chick to wild California Condors. Implications of these studies for the recovery of the California Condor will be discussed.

Raptor care and rehabilitation: precedents, progress, and potential.

JOHN E. COOPER (Royal College of Surgeons of England, London WC2A 3PN, England. Phone: 01-4053774).

Despite a close association between man and raptors for centuries, only recently has scientific study of these birds become a respectable and bona fide discipline. Over the past two decades much has been learned about the care and treatment of raptors. Nursing, therapy, rehabilitation, and release all necessitate specialized skills, coupled with an understanding of the biology and needs of the patient. Clinical work must be complemented by pathological examinations of carcasses, eggs, and embryos. Future developments will include improved diagnostic and therapeutic aids, advances in captive breeding, better collation of information, a more analytical approach to data, closer collaboration between different disciplines, and the extension of existing knowledge to conservation projects, especially overseas. Public attitudes to animals are also changing, however, and raptor biologists must be prepared to respond appropriately.

Uses for nonreleasable raptors.

WALTER C. CRAWFORD (Raptor Rehabilitation and Propagation Project, Inc., Tyson Research Center, Box 193, Eureka Missouri 63025. Phone: 314-938-6193).

With the interest in wildlife steadily increasing throughout the United States, more and more raptors are being brought to rehabilitation centers for treatment. Even with modern medical treatment, many of these specimens are unreleasable. This is especially true with birds, with most attention being directed toward raptors. Permanently injured raptors are normally euthanized, except in the case of endangered species. There are alternatives to euthanization. These include: education (using crippled birds to educate the general public); captive breeding (to produce offspring for release into the wild); and research (studies that will help us better understand birds of prey). This provides the use of an otherwise useless specimen. Every attempt should be made to utilize specimens for some positive use before euthanization is considered.

Research work in the field of captive breeding birds of prey.

CLAUS FENTZLOFF (German Raptor Centre, Burg Guttenburg, 6954 Burg Guttenburg/Neckar, West Germany. Phone: 06266-388).

In a short report the author presents his collection of data on hand-rearing, weight increases, and food intake of twenty-five species of raptors during the first three weeks. These data, with detailed instructions for the hand-rearing of birds of prey, are available upon request and are meant to help all animal lovers with the rearing of chicks. This report also shows ways of determining a bird's regional origins, which are important for the breeding of species in preservation programs. The results of a study on the effects of weather on breeding results in the past six years (from 1979 to 1985) are also reported.

Regeneration of mechanically removed feathers in raptors.

Murray E. Fowler (Department of Medicine, School of Veterinary Medicine, University of California, Davis, California 95616. Phone: 916-752-1363), BRET STEDMAN, and Terry A. Schulz (University of California Davis Raptor Center, Davis, California 95616. Phone: 916-752-6091).

The regeneration of mechanically removed feathers is important to veterinarians, rehabilitators, and falconers yet there is a paucity of literature on the subject. Preliminary studies indicate that only 50% of the remiges that were mechanically removed regenerated normally in 126 days. Significant differences in normal regrowth percentages of primary vs. secondary feathers and in Red-tailed Hawks (Buteo jamaicensis) vs. Common Barn Owls (Tyto alba) were noted. Only 20% of all primaries removed and 65% of all secondaries removed regrew normally. Ninety percent of all tail feathers regenerated normally within 60 days.

Hawks, buzzards, and falcons (Accipiter, Buteo, and Falco) captive breeding and artificial incubation.

ROBIN HAIGH (Surrey Bird Rescue and Conservation Centre, Chertsey, Surrey, England, United Kingdom. Phone: 09328 60236).

This paper will discuss captive breeding and artificial incubation in hawks, buzzards, and falcons. Results will be presented and discussed.

Post-release movements and survival of rehabilitated raptors.

LAYNE L. HAMILTON (Louisiana Cooperative Wildlife Research Unit, School of Forestry, Wildlife and Fisheries, Louisiana State University, Baton Rouge, Louisiana 70803. Phone: 504-388-4131), Glen H. Olsen (School of Veterinary Medicine, Louisiana State University, Baton Rouge, Louisiana 70803. Phone: 504-346-3146), and Phillip J. Zwank (Louisiana Cooperative Wildlife Research Unit, School of Forestry, Wildlife and Fisheries, Louisiana State University, Baton Rouge, Louisiana 70803. Phone: 504-389-0404).

Five rehabilitated raptors, 2 Red-tailed Hawks (Buteo jamaicensis), 1 Red-shouldered Hawk (B. lineatus), and 2 Barn Owls (Tyto alba), were equipped with tail-mounted transmitters and released on the Ben Hur Biological Research Area, East Baton Rouge Parish, Louisiana. Post-release movements were monitored and survival rates computed. Management implications for raptor rehabilitation programs are discussed.

Bald Eagle (Haliaeetus leucocephalus) semen collection 1980-1985.

LYNDON N. IRWIN (Department of Agriculture, Southwest Missouri State University, Springfield, Missouri 65804. Phone: 417-836-5088), Scott Erwin, Janis Collins, Paul Price, and Dale Tuttle (Dickerson Park Zoo, 3043 N. Fort, Springfield, Missouri 65803. Phone: 417-833-1570).

Three single-wing amputee Bald Eagle males have been used to develop a manual method of semen collection. The technique involves rapid catching and control of the males followed by manual stimulation. Stimulation involves forcefully stroking the back to the tail with the right hand and stroking the area around the vent with an upward motion from the sternum to the vent with the left hand. After approximately one minute, the tail is pushed back dorsally with the right hand. Semen is then obtained by gently squeezing around the everted vent (also with the right hand) being careful not to injure the bird with excessive pressure. Semen is collected into a small tube using gentle suction. In 1985, microscopic examination of semen from one of the males indicated that of sixteen samples obtained, fourteen contained viable sperm.

Principles of wound care and fracture management in birds of prey.

MICHAEL KOCK (International Wildlife Veterinary Services, P.O. Box 1413, Orangevale, California 95662-1413. Phone: 916-661-3046).

Wounded raptors and owls are presented to rehabilitation centers, private and university veterinary clinics, and wildlife departments with regularity. The medical management of these birds within the first twenty-four to forty-eight hours can be critical to recovery from trauma and

disease. Vigorous attention to medical, surgical, and nutritional factors will improve the chances for survival. A discussion of wound care is presented. Because many of these wounds are related to bone fractures, basic immobilization techniques for a variety of fractures are presented as well.

A simple methodical necropsy procedure for birds of prey.

NANCY KOCK (International Wildlife Veterinary Services, P.O. Box 1413, Orangevale, California 95662-1413. Phone: 916-661-3046).

Standardized, thorough post-mortem examinations need be neither difficult nor time consuming, but often provide valuable insight into the causes of illness and death. Conversely, in the absence of specific lesions, the list of possibilities can be narrowed by ruling out specific causes. In free ranging populations of animals, efficient disease diagnosis is important if protective or environmental measures are to be attempted. A simple, methodical approach to thorough post-mortem examinations of raptors will be presented.

Raptors: impacted by orchard insecticides.

EDWARD E. LITTRELL (California Department of Fish and Game, 1701 Nimbus Road, Suite F, Rancho Cordova, California 95670. Phone: 916-355-0136).

Raptors may be killed or injured by some orchard insecticide sprays. The California Department of Fish and Game (CDFG), Pesticide Investigations Unit, requests the aid of California wildlife rehabilitators in studying and resolving this problem. The CDFG needs tissues from animals thought to have been exposed to these insecticides. Samples from animal care centers will be analyzed to determine if cholinesterase enzyme activity has been depressed. A depressed level is symptomatic of poisoning. If analyses indicate a problem, the CDFG will work with the California Department of Food and Agriculture to reduce this threat to our raptors.

Caracaras in captivity.

JANE LYONS (Austin Nature Center, 2416 Barton Springs Road, Austin, Texas 78746. Phone: 512-327-8180).

This paper describes rehabilitation and captive breeding efforts concerning the Crested Caracara (Polyborus plancus). As a member of the Family Falconidae, the Caracara exhibits certain falcon-like physiological and behavioral traits. Yet, the species is considered aberrant because of a variety of unfalcon-like characteristics. The species is not common in the United States, and very little effort has been made to monitor its status. Research and propagation efforts have been undertaken by the author in conjunction with the U.S. Fish and Wildlife Service.

Barn Owl (Tyto alba pratincola) eggs: initial dimensions, weight loss, and incubation.

James D. Marshall (524 E. High Point Place, Peoria, Illinois 61614. Phone: 309-692-5000), CLAIRE H. HAGER (Raptor Rehabilitation and Propagation Project, Inc., Box 193, Eureka, Missouri 63025. Phone: 314-938-5586), and Gwyn McDee (Box 2007, Bartlesville, Oklahoma 74003).

One hundred seventy-seven eggs from 14 captive pair were studied to determine mean physical parameters, mean fractional weight loss, and incubation, since prior literature has been inconsistent with our data of previous years. A new coefficient was found for this species, since accurate fresh weight predictions have been inaccurate when applying existing mathematical equations, though there remains high correlation when compared to the coefficient used for all species but designed for Falco peregrinus.

The Negev Lappet-faced Vulture (Torgos tracheliotus negevensis): breeding project.

HEINRICH MENDELSSOHN (Department of Zoology, Tel Aviv University, Ramat-Aviv 69978, P.O.B. 39040, Israel).

The Negev Lappet-faced Vulture appears to be endemic in Israel; this population displayed a severe decline, concomitant with the development of human activity in its area of distribution. In 1975 the population consisted of only 7 breeding pairs; 3 nestlings were removed in order to start a captive breeding group. In 1980 only three breeding pairs remained and from then on almost every year eggs and nestlings were taken in order to enlarge the captive group. Double clutching was successful, and eggs were incubated at 36°C and 50% humidity. Nestlings were taken from the nests at the age of 2 months and reared in cages attached to aviaries with adult conspecifics. Incubator-hatched nestlings had a mirror in their artificial nest. When partly feathered, they were exposed during the day to adult Lappet-faced Vultures, and when fully feathered, they remained so round the clock. Birds reared this way did not later show social interest in people and behaved normally towards their conspecifics.

Notes about breeding biology and behavior of the genus Haliaeetus in Tierpark Berlin.

DIETER MINNEMANN (Tierpark Berlin, GDR-1136 Berlin Am Tierpark 125, German Democratic Republic. Phone: 5100111).

In the Berlin Animal Park we have six species of the genus (H. albicilla, H. leucocephalus, H. pelagicus, H. leucoryphus, H. vocifer, and H. leucogaster) which were reared there. Three species (H. albicilla, H. leucocephalus, and H. vocifer) are being bred. Roosting behavior, development of juveniles, and sounds of various species are being compared to each other. Our experience with breeding, pairing, and recognition of the sexes will be presented.

Notes about the breeding biology and behavior of the Harpy Eagle (Harpia harpyja) in Tierpark Berlin.

DIETER MINNEMANN (Tierpark Berlin, GDR-1136 Berlin Am Tierpark 125, German Democratic Republic. Phone: 5100111).

Since 1970 the Berlin Animal Park has had two Harpy Eagles. In 1981 we received a male on a breeding loan. In September 1981 the first Harpy hatched and was reared normally. In 1985 the fourth Harpy chick hatched. Within a space of five years, seven Harpy Eagles were intensively studied. Observations of roosting biology and behavior will be presented and discussed. Our experience with breeding Harpy Eagles is being compared with those in 15 different zoos.

Notes about the significance of sounds from juvenile birds of prey.

DIETER MINNEMANN (Tierpark Berlin, GDR-1136 Berlin AM Tierpark 125, German Democratic Republic. Phone: 5100111).

Studies were made of nest communication of 25 species of juvenile raptors. The vocalizations of the various species are very similar and contain the same information. By the end of the fledgling phase each species developed their own species' particular sounds. Adult birds have only four kinds of signals they can express (hunger, cold, feeling sick, and social contact). It may indicate that juvenile raptors can be reared by any of the other 25 species without adverse effects.

Ten-year breeding program for birds of prey in the Berlin Animal Park.

DIETER MINNEMANN (Tierpark Berlin, GDR-1136 Berlin Am Tierpark 125, German Democratic Republic. Phone: 5100111).

Berlin Animal Park houses some 67 species of diurnal birds of prey and 34 species or subspecies of owls. We have successfully bred 16 species of diurnal raptors and 20 species of owls. Some of these are the world's first breeding successes for particular species: Harpy Eagle (Harpia harpyja); Cinereous Vulture (Aegyphius monachus); Wedge-tailed Eagle (Aquila audax); and the African Sea Eagle (Haliaeetus vocifer). The experiences of the last 10 years have led us to believe that there are four basic criteria for breeding birds of prey and owl species. These criteria will be discussed.

Breeding birds of prey at the Japan Falconiformes Center.

KINYA NADAJIMA (The Japan Falconiformes Center, 470 Yamanote, Asahigaoka-cho, Owariasahi-shi, Aichi-ken, Japan).

This paper will describe the propagation efforts at the Japan Falconiformes Center. The Center was established in 1982 as a natural expansion of the Hawking Club of Japan. The Center energetically promotes a wide range of activities aimed at protecting Falconiformes, including breeding birds in captivity and releasing the young that are produced into the wild.

Rehabilitation of birds of prey at the Japan Falconiformes Center.

KINYA NADAJIMA (The Japan Falconiformes Center, 470 Yamanote, Asahigaoka-cho, Owariasahi-shi, Aichi-ken, Japan).

The Japan Falconiformes Center was established in 1982. The center is actively involved in the conservation of Falconiformes. This paper will describe our rehabilitation efforts.

Elf Owls (Micathene whitneyi): their potential for population management in California.

GAIL I. NAYLOR (The Peregrine Fund/Predatory Bird Research Group, Lower Quarry, University of California, Santa Cruz, California 95064. Phone: 408-429-2466) and Brian J. Walton (address same as above).

The Elf Owl has been listed as an endangered species in California. Elsewhere in its range it is locally common and has been studied more intensively, largely by Ligon. We were interested in applying techniques that had been developed for Peregrine Falcons to this very small and nocturnal species of owl in an effort to facilitate a population increase along the Colorado River between California and Arizona. Recent surveys have determined this species to be nearly extinct in this region. Small young were collected from a healthy population in Arizona for captive breeding stock in 1983. Chambers were constructed based on designs by McKeever for owls and The Peregrine Fund for falcons. Feeding regimes, food base, incubation techniques, and release techniques are being developed. Sexing of breeders, natural copulation of all captive pairs, fostering of young, and other breeding efforts have been successful. First releases from an experimental design release structure were made in 1985.

Surgical anatomy of the pectoral and pelvic limbs of cathartids.

SUSAN E. OROSZ (North Park Veterinary Hospital, San Diego, California 92112. Phone: 619-299-6020), Philip K. Ensley, and Donald L. Janssen (Zoological Society of San Diego, San Diego, California 92112. Phones: 619-231-1515 and 619-747-7049).

Anatomical studies of the pectoral and pelvic limbs of vultures and other birds of prey are lacking. This study documented the anatomy of the appendages of the Turkey Vulture (Cathartes aura) and related that anatomy to surgical approaches for long bone fracture repair of the California Condor (Gymnogyps californicus). The pectoral and pelvic limbs of four Turkey Vultures were radiographed, dissected, and photographed. Radiographs were taken of the limbs of one Andean Condor (Sarcoramphus papa) and the bones of one California Condor, placed in correct anatomical position. From these data, anatomical drawings were made to the scale of a California Condor. Drawings were also made of surgical approaches adapted for the vulture and the California Condor from those of Redig and Roush.

Rehabilitation of birds of prey at the Japan Falconry Center.
KINYO HADALIA (The Japan Falconry Center, 270 Yamano,
Asakusa-cho, Goshima-shi, Aichi-Pref., Japan).
The Japan Falconry Center was established in 1982. The center is
actively involved in the conservation of Falconiformes. This paper will
describe our rehabilitation efforts.

Kit Owa (Kitsun Owa): their potential for population management
in California.

GAIL I. WATSON (The Peregrine Fund/Peregrine Bird Research Group, Lower
County, University of California, Santa Cruz, California 95064. Phone:
408-439-7444) and Brian I. Watson (address same as above).

The Kit Owl has been listed as an endangered species in California.
Elsewhere in its range it is locally common and has been studied more
intensively, largely in Mexico. We were interested in applying techniques
that had been developed for Peregrine Falcons to this very small and
nocturnal species of owl in an effort to facilitate a population increase
along the Colorado River between California and Arizona. Recent surveys
have determined this species to be nearly extinct in this region. Small
young were collected from a healthy population in Arizona for captive
breeding stock in 1982. Chambers were constructed based on designs by
McKewen for owls and the Peregrine Fund for falcons. Feeding regimes,
food bases, incubation techniques, and release techniques are being
developed. Breeding of predators, natural copulation of all captive pairs,
fostering of young, and other breeding efforts have been unsuccessful. First
releases from an experimental design release enclosure were made in 1982.

Surgical anatomy of the pectoral and pelvic limbs of vulturids.
RONALD E. GROSS (North Park Veterinary Hospital, San Diego, California
92115. Phone: 619-449-8020), Philip K. Enaley, and Donald J. Janssen
(Zoological Society of San Diego, San Diego, California 92115. Phone:
619-521-1515 and 619-747-1249).

Anatomical studies of the pectoral and pelvic limbs of vulturids and
other birds of prey are lacking. This study documented the anatomy of the
appendages of the Turkey Vulture (*Cathartes aura*) and related that anatomy
to surgical approaches for long bone fracture repair of the California
Condor (*Gymnogyps californicus*). The pectoral and pelvic limbs of four
Turkey Vultures were radiographed, dissected, and photographed. Radio-
graphs were taken of the limbs of one Adams Condor (*Gymnogyps* sp.)
and the bones of the California Condor, placed in correct anatomical
position. From these data, anatomical drawings were made to the scale of
a California Condor. Drawings were also made of surgical approaches
adapted for the vulture and the California Condor from those of Redig and
Roush.

Common problems and mistakes with veterinary and nursing care of birds of prey.

W. JOEL PASCO, D.V.M. (Avian and Exotic Animal Practice, 2350 W. La Palma Ave., Anaheim, California 92801. Phone: 714-776-3751).

A collection of color slides vividly demonstrates the more common mistakes and problems encountered with birds of prey that have been referred to our wildlife care center, the largest free wild bird care center in Orange County. Many of these problems and mistakes are commonly made, not only by the novice but also by many professionals in the veterinary field. Problems covered include improper restraint and bandaging techniques, improper housing, husbandry problems, and feeding mistakes. Imprinting, exercising, and release problems will also be covered.

An aggressive Burrowing Owl (Athene cunicularia) rescue project.

JOAN PRIEST (Humane Society of Santa Clara Valley, Wildlife Department, 2530 Lafayette Street, Santa Clara, California 95050. Phone: 408-727-3383 or 408-269-BIRD).

A program to rescue, rehabilitate, and relocate Burrowing Owls from land development areas throughout Santa Clara County was initiated by the Wildlife Department of the Humane Society of Santa Clara Valley. In the fall of 1983 a plan was presented to our Fish and Game Warden and given his full approval. Volunteers spent time during the fall and winter months doing literature searches, finding suitable release sites, notifying contractors of the problem and solution, preparing funding, and setting up banding criteria. The past two nesting seasons have brought some success, some distress, and some surprising discoveries. It is tragic and wasteful to bury owls alive! We are working to make a difference. You, too, can make a difference by initiating a similar program in your area.

Experiences and results using surrogate parents to raise and rehabilitate orphaned raptors.

TERRY A. SCHULZ (University of California Davis Raptor Center, Davis, California 95616. Phone: 916-752-0176).

Orphaned raptors present the rehabilitator with two main problems: the provision and maintenance of their physical well-being and maintenance of their behavioral and psychological well-being. It is generally agreed by animal behaviorists that early experiences have a profound effect on adult behavior. Most young raptors raised without the company of a conspecific may suffer permanent behavioral defects. However, experiences with the Common Barn Owl (Tyto alba) indicate that the effects of imprinting can be reversed. The use of nonreleasable adult raptors as surrogate parents has proven successful in five species of Strigiformes and six species of Falconiformes. Besides reducing cage trauma in species which are innately nervous or "flighty" in captivity, this method best achieves the behavioral and psychological well-being of the orphaned raptor.

Common problems and mistakes with veterinary and nursing care of birds of prey.
 W. JOEL PASCO, D.V.M. (avian and Exotic Animal Practice, 2120 W. La
 Palma Ave., Anaheim, California 92801. Phone: 714-775-2721).
 A collection of color slides vividly demonstrates the more common
 mistakes and problems encountered with birds of prey that have been
 referred to our Wildlife Care Center, the largest free wild bird care
 center in Orange County. Many of these problems and mistakes are commonly
 made, not only by the novice but also by many professionals in the
 veterinary field. Problems covered include improper handling and
 handling techniques, improper housing, husbandry problems, and feeding
 mistakes. Feeding, watering, and release problems will also be
 covered.

An aggressive Burrowing Owl (*Speotyto cunicularia*) rescue project.
 JONAS PERLBERG (Human Society of Santa Clara Valley, Wildlife Department,
 2520 Lafayette Street, Santa Clara, California 95050. Phone: 408-751-1282
 or 408-244-8100).
 A program to rescue, rehabilitate, and relocate burrowing owls from
 land developments across throughout Santa Clara County was initiated by the
 Wildlife Department of the Human Society of Santa Clara Valley. In the
 Fall of 1983 a plan was presented to our club and Gene Warden and given
 his full approval. Volunteers spent time during the fall and winter
 months doing intensive searches, finding suitable release sites, notifying
 neighbors of the problem and solution, preparing funding, and setting up
 banding outfits. The past two nesting seasons have brought some success,
 some distress, and some surprising discoveries. It is fragile and wonderful
 to bury owls alive! We are working to make a difference. You, too, can
 make a difference by initiating a similar program in your area.

Experiments and results using surrogate parents to raise and rehabilitate
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 TERRY A. SCHULTZ (University of California Davis Raptor Center, Davis,
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 reversed. The use of nonconspecific adult raptors as surrogate parents has
 been successful in five species of birds of prey and six species of
 falconiformes. Besides reducing early trauma in species which are innately
 nervous or "flighty" in captivity, this method best achieves the behavioral
 and psychological well-being of the orphaned raptor.

Single-sex pairing in captive American Black Vultures (Coragyps atratus).

DONALD J. STERNER and William D. Toone (San Diego Wild Animal Park, San Pasqual, California 92025. Phone: 619-747-8702).

Pairing between birds of the same sex is more common than previously suspected. Gulls, hawks, and other birds have demonstrated this behavior. Observations of three female Black Vultures housed together at the San Diego Wild Animal Park indicates that female-female pairing occurs in New World vultures. Two of these birds paired and harassed the third bird which was subsequently removed from the cage. Although no copulations were seen, the pair courted, laid an egg, and shared incubation duties. Single-sex pair bonds may occur in birds due to limited mate choice. Data from the National Zoo from the early 1900s suggest the possibility that captive female California Condors may have displayed this behavior. Recent field observations show that this behavior may also occur in the wild. Documentation that unisexual pairing occurs in cathartids may have implications from the standpoint of management of small populations of vultures. It may also be a favorable tool when artificial insemination is utilized as a captive management technique.

Reestablishment of the Harris' Hawk (Parabuteo unicinctus superior) to the Lower Colorado River.

GLENN R. STEWART (Ventana Wilderness Sanctuary. P.O. Box 894, Carmel Valley, California 93924. Phone: 408-429-2466) and Brian J. Walton (The Peregrine Fund/Predatory Bird Research Group, Lower Quarry, University of California, Santa Cruz, California 95064. Phone: 408-429-2466).

One hundred five Harris' Hawks were released at hack sites and cross-fostered to Red-tailed Hawks in an effort to reestablish a native population along the lower Colorado River in California and Arizona from 1979 to 1985. "Mega-hack" releases were tested as were other hacking techniques. Released birds have paired and produced young on at least two occasions since the program was initiated. Selected individuals were marked with color bands and radio-telemetry transmitters to determine success in gaining independence and to monitor individuals and their movements after release.

Techniques for captive rearing of California Condors (Gymnogyps californianus) from eggs removed from the wild.

C. Kuehler Toone (San Diego Zoo Research Department, P.O. Box 551, San Diego, California 92112. Phone: 619-231-1515 Ext. 450) and WILLIAM D. TOONE (San Diego Wild Animal Park, San Pasqual, California 92025. Phone: 619-747-8702).

The wild population of California Condors is declining. Biologists from the U.S. Fish and Wildlife Service, California Department of Fish and Game, and the National Audubon Society are working together to ensure the species' survival. A captive population is being developed at the San Diego Wild Animal Park and the Los Angeles Zoo by double-clutching wild breeding pairs. This conservation method is dependent upon successful artificial incubation of eggs and captive rearing of chicks. Based on experience with four other species of New World vultures, in addition to data shared by the Bronx Zoo, Patuxent Wildlife Research Center, and The

Single-sex pairing in captive American Black Vultures (*Corvus americanus*)
 DONALD J. STEWART and William D. Toome (San Diego Wild Animal Park, San
 Pasqual, California 92075. Phone: 619-747-8702).

Pairing between birds of the same sex is more common than previously
 suggested. Gulls, ducks, and other birds have demonstrated this behavior.
 Observations of three female Black Vultures housed together at the San
 Diego Wild Animal Park indicate that female-female pairing occurs in New
 World vultures. Two of these birds paired and decreased the third bird
 which was subsequently removed from the cage. Although no copulations
 were seen, the pair courted, laid an egg, and shared incubated duties.
 Single-sex pair bonds may occur in birds due to limited mate choice. Data
 from the National Zoo from the early 1900s suggest the possibility that
 captive female California Condors may have displayed this behavior.
 Recent field observations show that this behavior may also occur in the
 wild. Documentation that natural pairing occurs in certain birds may have
 implications from the standpoint of management of small populations of
 vultures. It may also be a favorable tool when artificial insemination is
 utilized as a captive management technique.

Reestablishment of the Harlequin Hawk (*Parabuteo unicinctus superciliosus*) to the
 Lower Colorado River.
 ALAN S. STEWART (Vandenberg Wildlife Sanctuary, P.O. Box 894, Carmel,
 California 93924. Phone: 408-429-2466) and Brian J. Walton (The
 Peregrine Fund/Peregrine Bird Research Group, Lower Quarry, University of
 California, Santa Cruz, California 95064. Phone: 408-429-2466).

One hundred five Harlequin Hawks were released at dark sites and cross-
 located to red-tailed Hawks in an effort to reestablish a native popula-
 tion along the lower Colorado River in California and Arizona from 1979 to
 1982. "Hawk-bank" releases were tested as were other banding techniques.
 Released birds have paired and produced young on at least two occasions
 since the program was initiated. Selected individuals were marked with
 color bands and radio-telemetry transmitters to determine success in
 gaining independence and to monitor individuals and their movements after
 release.

Techniques for captive rearing of California Condors (*Condor*)
 (Condor) (from eggs removed from the wild).
 C. Richard Toome (San Diego Research Department, P.O. Box 527, San
 Diego, California 92112. Phone: 619-591-1512 Ext. 430) and WILLIAM D.
 TOOME (San Diego Wild Animal Park, San Pasqual, California 92075. Phone:
 619-747-8702).

The wild population of California Condors is declining. Biologists
 from the U.S. Fish and Wildlife Service, California Department of Fish and
 Game, and the National Audubon Society are working together to ensure the
 species' survival. A captive population is being developed at the San
 Diego Wild Animal Park and the Los Angeles Zoo by double-clutching wild
 breeding pairs. This conservation method is dependent upon successful
 artificial incubation of eggs and captive rearing of chicks. Based on
 experience with four other species of New World vultures, in addition to
 data shared by the Bronx Zoo, Patuxent Wildlife Research Center, and The

Peregrine Fund, Inc., the Zoological Society of San Diego developed a protocol for hatching and rearing California Condors. To date, 12 condor chicks have been successfully raised from 15 eggs removed from the wild (hatchability: 87%, survivability: 92%). These birds will form the nucleus of a captive population for future breeding and reintroduction.

Incidence of blood parasites infecting Swainson's Hawks (Buteo swainsonii).

Diane Van de Water, Peter H. Bloom (Department of Biology, California State University, Long Beach, California 90840. Phone: 213-832-5645), and MARJORIE J. GIBSON (Red-tail Research Foundation, Inc., 6421 Via Canada, Rancho Palos Verdes, California 90274. Phone: 714-974-0647).

The role of blood parasites as possible causes of mortality among birds of prey is discussed with special emphasis placed upon the Swainson's Hawk. The relative pathogenicity of the hematozoa (blood inhabiting protozoa) is dependent upon the level of infection, parasite virulence, host stress, and possible concomitant infections or other disease agents. During the first week of July 1982 and July 1983 blood smears were collected from 17 Swainson's Hawks during routine banding procedures in Modoc County, California. The smears were immediately fixed in absolute methanol and later stained with Giemsa. Haemoproteus and Leucocytozoon were found with a combined infection rate of 47%.

Normal bacterial flora of the crops and cloacas of healthy Peregrine Falcons (Falco peregrinus) housed in captivity.

PATRICIA G. ZENONE, James A. Fangmeier, and Brian J. Walton (The Peregrine Fund, c/o Santa Cruz Predatory Bird Research Group, Lower Quarry, University of California, Santa Cruz, California 95064. Phone: 408-429-2466).

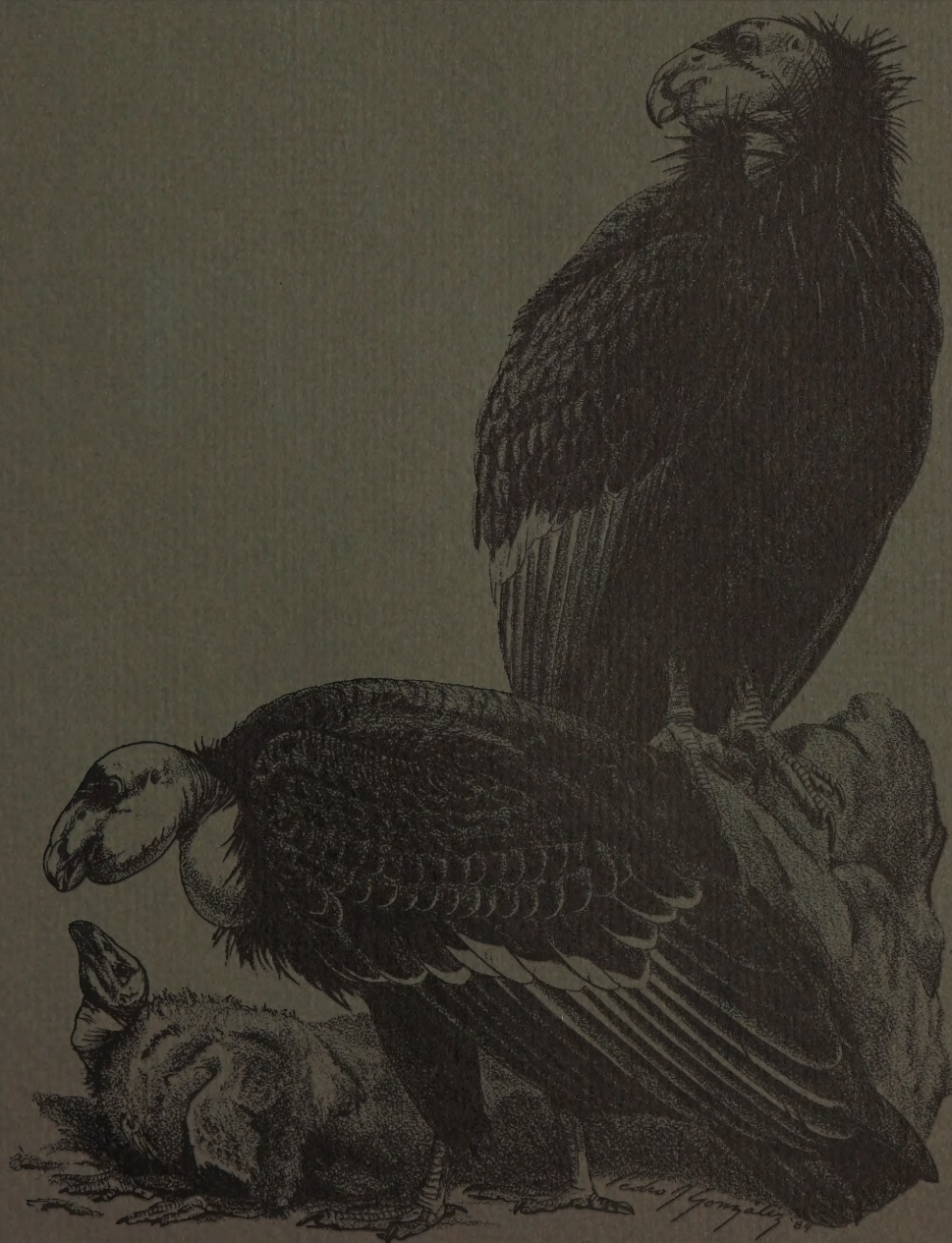
In order to enable more accurate diagnoses and treatments of falcons with bacterial infections, we sampled and analyzed the normal, aerobic bacterial flora of the crops and cloacas of 13 healthy adult Peregrines housed at the Santa Cruz raptor breeding facility. The bacteria present were found to be mostly gram positive organisms, including at least eight species of Staphylococcus, Streptococcus sp., Corynebacterium sp., and Bacillus sp. Much lower numbers of gram negative bacteria were present, and these included organisms such as Proteus vulgaris and P. mirabilis, Escheria coli, Enterobacter agglomerans, and Pseudomonas aeruginosa. Almost all of the bacteria isolated exhibited gamma, or no apparent, hemolysis, although a few alpha- and beta-hemolytic types were also present. In addition, every Peregrine sampled exhibited the presence of some yeast in either the crop or cloaca or both. However, in most cases the amount was so low that it was only detected after an enrichment procedure.

1985 RAPTOR RESEARCH FOUNDATION

SYMPOSIUM ON THE MANAGEMENT OF BIRDS OF PREY

INTERNATIONAL MEETING

Saturday, November 2 and Sunday, November 3
Second International Vulture Symposium



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* ABSTRACTS *

SESSION 3.

INTERNATIONAL VULTURE SYMPOSIUM

November 2-3, 1985
Sacramento, California

Hosted by:

Raptor Research Foundation, Inc.

Held in conjunction with the 1985 Raptor Research Foundation Symposium
on the Management of Birds of Prey, International Meeting

Sponsored by:

Bureau of Land Management
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The National Audubon Society
Pacific Gas and Electric Company
The Peregrine Fund, Inc.

Southern California Edison Company
San Francisco Zoological Society
U.S. Fish and Wildlife Service

The Western Foundation of Vertebrate Zoology

Exhibiting Old World vultures in a large, open enclosure.

Lance Aubrey and NANCY CLARK (San Diego Wild Animal Park, San Pasqual, California 92025. Phone: 619-747-8702).

The exhibition of pinioned Old world vultures in a large, open enclosure is a relatively new concept in captive vulture management. The San Diego Wild Animal Park recently added two species of Old World vultures to their animal collection. Ruppell's Vultures (Gyps ruppellii) and African White-backed Vultures (Gyps africanus) are now being exhibited in a spacious, 120-acre enclosure. Sharing this enclosure with the vultures are various East African hoofstock and bird species. Some of the obstacles that had to be overcome were: escapes, trauma by cagemates, and competition for food. Pinioned vultures have proven to be capable of gliding into the next enclosure when the wind is favorable. Providing suitable roosting sites was another challenge which was met by relocating a large tree snag to a knoll in the highest point of the enclosure. As these vultures mature, pair formation and nesting structures will be future considerations.

Census and breeding status of Cape Vultures (Gyps coprotheres) in the Transvaal, Republic of South Africa.

PATRICK C. BENSON 1 (Phone: 0152792 Bochum 1121), Warwick R. Tarboton 2 (Phone: 015232 848), Joan C. Dobbs 1, and David G. Allan 2 (Phone: 011 659-0488). (1 = Department of Zoology, University of Witwatersrand, Johannesburg, 2001, Republic of South Africa; 2 = Nature Conservation Division, Transvaal Provincial Administration, Pretoria 0001, Republic of South Africa).

The Cape Vulture's classification as a vulnerable species was continued in the 1984 South African Red Data Book (SA-RDB). The Transvaal Province contains the majority of known breeding sites. During 1981-1985, 11 Transvaal colonies were censused using aerial and ground count techniques. The two largest colonies, Blouberg and Kransberg, were monitored regularly using ground counts, aided by aerial photos, for two and five years, respectively. Blouberg contained nearly 800 pairs, and Kransberg included about 900 pairs. We estimate the Transvaal breeding population to be 3,000 pairs, twice the 1984 SA-RDB estimate. Aerial census generally undercounts breeding pairs due to incomplete photo coverage, poor photo quality, and early nest failure. The more accurate ground survey requires prolonged observations to determine the presence and status of nests. Used together, these techniques allow for an accurate assessment of total nest numbers, yearly changes in nest numbers and site usage, and total reproductive success.

Long-term effect of human disturbance on the reproductive behavior of Cape Vultures (Gyps coprotheres).

Patrick C. Benson and JOAN C. DOBBS (Department of Zoology, University of Witwatersrand, Johannesburg, 2001, Republic of South Africa. Phone: 0152792 Bochum 1121).

The effect of human disturbances on reproductive behavior in Cape Vultures was monitored at the Kransberg colony for three successive years. Both human activities and vulture nest attendance during climbs was recorded for all sites affected (noting both distance of climbers from the

nests and visibility of climbers to the birds). Human disturbance was quantified by measuring nest attendance/desertion during and after a particular disturbance, hatching and fledging success, and nest site reoccupancy. This was compared for over 900 active nest sites (disturbed and undisturbed). Results indicate that 1) eggs fail to hatch with less than two hours of exposure to the wind; 2) parents would leave a chick unattended overnight; and 3) nest desertions occurred. More importantly, disturbed nest sites (even when young successfully hatched) yielded significantly lower reoccupation the following breeding season than either the undisturbed group or those disturbed by baboons.

Profile and preliminary significance of egg waste estrogens (EWE) analyzed from day-old California Condors (Gymnogyps californianus).

ARDEN BRYAN BERCOVITZ (San Diego Zoo Research Department, P.O. Box 551, San Diego, California 92112. Phone: 619-231-1515 Ext. 450).

Accumulated excrement (allantoic urates and cloacal expressions) was collected on the day of hatching from 10 artificially incubated California Condors. Samples were homogenized with acetate buffer (pH 5), incubated overnight at 5°C, and stored frozen prior to hydrolysis. Beta-glucuronidase/aryl-sulfatase (Helix pomatia preparation, 0.05 ml/1.0 ml homogenate, 37°C incubation for 24 h) was used for enzymatic hydrolysis, followed by anhydrous diethyl ether extraction. Ether supernates were decanted, dried, and resuspended in 0.05 ml methanol for high performance liquid chromatography to isolate individual components analyzed by a nonspecific estrogen radioimmunoassay. Estrone, estradiol, and other uncharacterized polar estrogenic substances were measurable. Total estrogens and estradiol levels were higher in females than males and indicated sex in all chicks. Application of EWE analysis as a noninvasive chick sexing method will be discussed.

The Andean Condor as a research surrogate for the California Condor.

James W. Carpenter, F. Joshua Dein, and DAVID H. ELLIS (Patuxent Wildlife Research Center, U.S. Fish and Wildlife Service, Laurel, Maryland 20708. Phone: 301-498-0494).

Captive propagation of Andean Condors (Vultur gryphus) was initiated at the Patuxent Wildlife Research Center in 1966 in anticipation of the need to apply resulting techniques to the captive breeding of the endangered California Condor (Gymnogyps californianus). This report summarizes the progress made on this Andean Condor breeding and research project, with emphasis on recent fostering/cross-fostering studies. These studies include: a) fostering eggs/chicks between Andean Condors; b) fostering of two chicks each to Andean Condor pairs; c) cross-fostering of a Turkey Vulture (Cathartes aura) to Andean Condors; and d) cross-fostering an Andean Condor chick to wild California Condors. Implications of these studies for the recovery of the California Condor will be discussed.

Lesser Yellowheaded Vulture (Cathartes burrovianus) abundance and distribution in Mexico and Belize, Central America.

Jack Clinton-Eitnrear (Belize Zoo, P.O. Box 474, Belize City, Belize), and STEVEN M. MCGHEE (612 North Main Suite 239, McAllen, Texas 78501. Phone: 512-631-8757).

The Lesser Yellowheaded Vulture differs from the more abundant Turkey Vulture (Cathartes aura) by its smaller size and yellowish-orange head coloration. Despite this, these two species are very hard to distinguish in the field. In light of this and its habitat preference for marshy areas, its distribution and abundance remain poorly documented. Data were collected during five trips into Mexico in 1983-85 and three trips into Belize during 1982-83 and 1985. Apparently the Yellowheaded Vulture is seasonally abundant in northern Belize and southeastern Mexico, and its numerical status has decreased throughout its historical range in northeastern Mexico.

Preliminary report on the development and use of an automatic tracking system.

William W. Cochran (Illinois Natural History Survey, 607 East Peabody Drive, Champaign, Illinois 61820. Phone: 217-352-6849) and VICKY J. MERETSKY (Condor Research Center, 2291A Portola Road, Ventura, California 93003. Phone: 805-644-1766).

A multi-channel tracking system is being used to monitor California Condors (Gymnogyps californianus) equipped with patagially mounted radio transmitters. Two automated receivers are located on high mountains, and one is in the San Joaquin Valley. Their positioning and altitude provide baselines of the order of 60 km and coverage which includes the southern end of the valley and the surrounding Sierra Madre, Tehachapi, and Sierra Nevada Mountains. The automated receivers are accessed by telephone each day, and the data are fed to a central computer for storage and analysis. Data are analyzed to provide approximate flight paths and a daily index that assures that each condor is alive or else signals personnel of the possibility of a death. The latter condition calls for a ground and air search. The primary problem to date has been poor reliability and performance of transmitters.

Roosting, nesting, and foraging habitat of Black and Turkey Vultures.

JOHN S. COLEMAN, James D. Fraser (Department of Fisheries and Wildlife, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061. Phone: 703-961-6064), and H.J. Greenlee (Gettysburg National Military Park, Gettysburg, Pennsylvania 17325. Phone: 717-334-1124).

We studied habitat use by eleven radioed Black Vultures and ten radioed Turkey Vultures in south central Pennsylvania in 1983 and 1984. An additional 190 vultures were patagially marked. Black and Turkey Vultures consistently used home ranges that contained a greater percentage of roaded and open habitat than did the 71,000-ha study area. All nests were in caves in forested diabase extrusions. Within their home ranges vultures preferred forested and undeveloped areas for diurnal perching and roosting. Roosts were often in habitat with roads, but were removed from other human activities. While feeding, both species preferred pasture and cropland.

The forest-pasture edge was an important aspect of habitat. Urban areas were avoided. Protection of select areas for roosting and nesting within a region of livestock oriented agriculture may be enough to maintain vulture populations.

Growth and behavior of captive California Condors: after the first year.

CATHLEEN R. COX and Valentina I. Goldsmith (Los Angeles Zoo, 5333 Zoo Drive, Los Angeles, California 90027. Phone: 213-666-4650).

Activity budgets for each month of the year are presented for 7 California Condors--6 juveniles and 1 adult. Observations were made over an 18-month period, and changes in activities with increasing maturity are presented. The juveniles' activities are compared and contrasted with those of the adult. The adult's behavior differs in that only he gives courtship displays and actively explores his nest box. These reproductive activities peak in April and fall to a low level in July and August.

Variation in California Condor behavior as a function of weather conditions.

CATHLEEN R. COX and Nicolette S. Miller (Los Angeles Zoo, 5333 Zoo Drive, Los Angeles, California 90027. Phone: 213-666-4650).

Several behaviors seen in cathartids are thought to serve a thermoregulatory function. We explore this hypothesis based on observations of captive California Condors. Behaviors considered are covering the head and neck region by raising the neck ruff, sunning, urohidrosis, and panting. The likelihood of each of these behaviors occurring is shown as a function of variation in environmental conditions. Parameters considered include temperature, cloud cover, and relative humidity.

Comparative study of bone growth in wild and captive-raised Cape Vulture (Gyps coprotheres) chicks.

JOAN C. DOBBS and Patrick C. Benson (Department of Zoology, University of Witwatersrand, Johannesburg, 2001, Republic of South Africa. Phone: 0152792 Bochum 1121).

To determine whether the 3% incidence of bone abnormalities in wild Cape Vulture nestlings was related to diet, a comparative bone growth study was conducted on 6 captive-raised chicks. A whole meat diet was supplemented with chips of bone to provide calcium at 6 levels (0.1 to 1.5% of the diet). X-rays from these birds were compared to wild chicks accidentally poisoned by strychnine. Only the 0.1% level of calcium produced any bone abnormalities or had high alkaline phosphatase levels. Mineral analyses of skeletons from poisoned vultures indicate that the concentration in wild vulture skeletons increased throughout growth, with subadult vultures still containing less mineral than adults. Wild birds with rehealed breaks were no different in calcification than healthy vultures of a comparable size. A few wild chicks had hypertrophied bones similar to the chick on the 0.1% diet. Bones from these skeletons contained less total ash and calcium than normal chicks indicating a possible calcium deficiency in these birds.

The effect of strychnine poisoning on the Cape Vulture (Gyps coprotheres).

JOAN C. DOBBS and Patrick C. Benson (Department of Zoology, University of Witwatersrand, Johannesburg, 2001, Republic of South Africa. Phone: 0152792 Bochum 1121).

Cape Vultures breed within easy flying distance of ranching land. They are also prone to eating poisoned carrion placed for mammalian predators. To evaluate the real danger of strychnine poisoning, samples of vulture carcasses from two colonies in South Africa and one in Botswana were collected over four years and analyzed for strychnine poisoning. Vultures from all three colonies proved strychnine positive, adults being the main victims. There were at least six unique poisoning incidents at the Kransberg colony in both 1982 and 1983 with a total of 39 freshly poisoned adults and subadults found over the two years. The total number of vultures poisoned is unknown since only birds returning to the cliff were found. Chicks were affected: directly by poisoned food or indirectly by changes in food intake or predation when left unattended. The trend in nest failures would indicate only a small number of victims were found. Poisoning has also occurred at other colonies and should be considered the most important factor affecting Cape Vulture populations.

An artificial feeding program for California Condors.

JESSE GRANTHAM, Gregory Sanders, Peter H. Bloom (Condor Research Center, 2291-A Portola Road, Ventura, California 93003. Phone: 805-633-1766), and D. Bruce Barbour (Alkali Lake Sanctuary, National Audubon Society, R.R. 1, Box 79A, Spiritwood, North Dakota 58481. Phone: 701-252-3822).

A random based feeding program with regard to location, carcass type, and frequency of placement was begun in early 1981 for wild California Condors. These early efforts were largely unsuccessful until modifications were made on carcass type and location. These changes were based on observations of foraging condors. Beginning in April of 1985 carcasses were placed out on a consistent daily basis in a high-use area, and condors began to feed almost exclusively on these carcasses. Early attempts at baiting are compared with these later successful baitings. The positive impact of this feeding program on this critically endangered species is discussed.

Conservation of vultures in (developing) India.

ROBERT GRUBH, Goutam Narayan, and S.M. Satheesan (Bombay Natural History Society, Hornbill House, S.B. Singh Road, Bombay 400023. Phone: 225155, 243869).

Out of seven species of Griffon Vultures of the genus Gyps, four are found in India, and none of them is presently threatened. However, due to easy availability of food the Indian Whitebacked Vulture (Gyps bengalensis) has proliferated phenomenally in urban areas of Indo-Gangetic plains and has become a major hazard to aircraft. This has led to decisions favoring mass killing of vultures using chemicals. Since these vultures are the only effective scavengers of dead and putrefying animals in urban and rural areas and in forests, this proposal for extermination if effectively implemented might lead to unprecedented ecological and social havoc. Ecological measures suggested by us include proper utilization of the

surplus vulture food by converting it into suitable by-products. This will eliminate the hazardous vulture population in and around urban areas while maintaining their optimum number in forests and the countryside.

Food searching by neotropical vultures.

DAVID C. HOUSTON (Department of Zoology, Glasgow University, Glasgow 12 800, Scotland. Phone: 0044 339 8855).

A series of baits have been used to study the role of cathartid vultures in neotropical forests. Cathartes species rely almost entirely on their sense of smell to locate carrion. They cannot easily find animals that have died recently, are highly efficient at finding carcasses about one day old, but tend to reject meat that is rotten. King Vultures and Black Vultures are dependent on the Cathartes species to be led to food. There is competition between these species, but vultures overall are the major scavengers in neotropical forests, accounting for over 90% of the carrion food supply.

Habitat assessment and management planning at a California Condor roost.

WILLIAM E. LEHMAN and George P. Sheppard (U.S. Bureau of Land Management (BLM), Caliente Resource Area, 520 Butte Street, Bakersfield, California 93305. Phone: 805-861-4236).

Blue Ridge is a historic California Condor roost site determined to be Critical Habitat for the condor by the U.S. Fish and Wildlife Service (FWS) in 1976. Research quantifying condor use, human use, and habitat conditions began at Blue Ridge in 1980 and continued in 1983 through 1985. Condor use of the roost appears to be heaviest from June through August, with occasional use in the spring and fall. Condors used the roost 30 times from June through October, 1983, and 48 times in 1984. However, in 1985 condor roosting at Blue Ridge fell drastically to only two incidents of use. Habitat features important to condors at Blue Ridge include numerous large ponderosa pine snags and two drinking and bathing areas. Historically, condors have used many snags at Blue Ridge. However, from 1983 to 1985 only four snags were used regularly, with about 85% of the use occurring in one favored snag. Though summer homes, communication towers, and roads occur within one-quarter to one mile of the roost trees, most human activity is limited by topography, brush, and locked gates. In 1985 research and management efforts culminated in the development of a Habitat Management Plan (HMP) designed to maintain and improve necessary habitat conditions for the condor. HMP development at Blue Ridge was particularly challenging, because the Critical Habitat has four private and three public landholders (FWS, BLM, and the California Department of Fish and Game). To consolidate these disparate interests into a mutually acceptable plan, a Blue Ridge Coordinating Committee was established consisting of the involved agencies. A BLM representative also met with most private parties, who were apprised of and invited to join in the HMP process. Implementing the HMP is expected to take five to seven years.

The rapid decline of the four vulture species in Israel.

YOSSI LESHEM (Israel Raptor Information Center, Society for the Protection of Nature in Israel, Har Gilo, D.N. Harei Jerusalem 91076, Israel. Phone: 02-741661).

The population of the four vulture species breeding in Israel has drastically declined during the past four decades. The Bearded Vulture (Gypaetus barbatus) has stopped breeding regularly since 1981, and only two pairs remain in the Judean Desert. Only one pair of Lappet-faced Vultures (Torgos tracheliotus negevensis) nested in 1985 out of a population that had once comprised 25-30 pairs. An additional 2-4 individuals of this species were observed in 1985. Sixty-four pairs of Griffon Vultures (Gyps fulvus) bred in 1985, probably only 3-5% of the original population. Ninety-two pairs of Egyptian vultures (Neophron percnopterus) nested in 1985, about one-fifth of the number breeding in the past. The Egyptian Vulture is the only species whose population is once again on the rise. The principal reasons for the declines are: development of modern agricultural methods and intensive use of pesticides; significant decrease in food sources due to the reduction in the number of herds of sheep and cattle and wildlife hunting between World War I and the 1950's; low reproductive potential; and damage to the natural environment concurrent with the development of the country. Between September 1982 and August 1984, 43 Griffon Vultures were electrocuted in northern Israel, roughly about one quarter of the population in that region. The vultures were mainly juveniles, and most met their death along a high power line in the western Golan Heights. The Israeli Electric Company erected landing platforms which have put a stop to the electrocutions. There is need of an international effort to establish a breeding nucleus of Torgos tracheliotus negevensis in Israel. There are four adult individuals in zoos in France and Holland which should be brought in as well. Thus, there is hope that sometime in the future Lappet-faced Vultures may once again be released in Israel.

Movement and foraging patterns by radioed California Condors (Gymnogyps californianus).

JOHN C. OGDEN (Ornithological Research Unit, National Audubon Society, 115 Indian Mound Trail, Tavernier, Florida 33070. Phone: 305-852-5092), Jesse Grantham, Peter H. Bloom, and Gregory Sanders (Condor Research Center, 2291A Portola Road, Ventura, California 93003. Phone: 805-644-1766), D. Bruce Barbour (Alkali Lake Sanctuary, National Audubon Society, R.R. 1, Box 79A, Spiritwood, North Dakota 58481. Phone: 701-252-3822), and Lawrence Riopelle (Ecosystems Research Unit, National Audubon Society, Route 6, Box 1877, Naples, Florida 33964. Phone: 813-657-2532).

An adult male condor (from a mated pair) and a subadult male were radioed during October-November 1982. Daily and seasonal movement patterns by these condors through 1984 are reported. Both birds covered major portions of the present range, although the subadult moved over greater distances and more frequently than did the adult. During non-breeding seasons both condors fed two to three times per week. The adult associated primarily with its mate, while the subadult associated with other non-breeding condors.

Social organization of Black Vulture (Coragyps atratus) roosts.

PATRICIA PARKER RABENOLD (Department of Biological Sciences, Purdue University, West Lafayette, Indiana 47907. Phone 317-494-4726).

In a five-year study of a partially marked population of Black Vultures in North Carolina, family members maintained contact throughout the year despite great fluctuations in roosting group membership. Furthermore, alliances among families exist which are independent of distance between nest sites. Two measures of movement agree that juveniles move least, adults are intermediate, and young adults range farthest. There is pronounced age-related dominance, and observations of fights among marked birds in a roost suggest that losers do not remain long at that roost. Adults are the first finders of food; juveniles and young adults are under-represented on initial days at food. Breeding adults concentrate year-round movements to the roosts nearest their nests and win more fights there than farther away. These results are interpreted in light of the hypothesis that avian communal roosts serve as food-finding information centers. Finders of food (adults) can to some extent control the number and identity of nonfamily competitors in the area by means of aggressive interactions in roosts.

A technique for assessing sublethal effects of Compound 1080 on vultures.

GARY M. SANTOLO and D. Michael Fry (Department of Avian Sciences, University of California, Davis, California 95616. Phone 916-752-1300).

A method for quantitatively evaluating coordination during flying and performance of repeated learned tasks has been developed to evaluate sublethal effects of the rodenticide 1080 on carrion-feeding birds. Vultures are trained to perform specific tasks in a large flight cage; performance before and after exposure to 1080 is monitored and evaluated using timed sequences on video tape. Performance is quantified and correlated with tissue residue levels and histopathology of the central nervous system. One-trial learning is tested by offering poisoned and non-poisoned carcasses to the vultures. Their ability to detect and avoid poisoned carrion is evaluated. Birds eating poisoned carcasses are observed to determine if emesis is a protective mechanism and to monitor the exact amount of 1080 ingested. Sublethal effects of the metabolic toxin 1080 (sodium monofluoroacetate) may include axonal dystrophy resulting in permanent neuron damage and reduced ability to fly and forage. This work was supported by the California Department of Fish and Game.

The California Condor: status and future prospects.

J. MICHAEL SCOTT (Project Leader, Condor Research Center, 2291-A Portola Road, Ventura, California 93003. Phone: 805-644-1766).

The California Condor (Gymnogyps californianus) has declined from an estimated population of 50-60 birds in 1968 to 6 birds in the wild in 1985. The population has decreased in size 61% since the fall of 1982. This dramatic decrease in the number of condors has occurred simultaneously with a decrease in the number of breeding pairs: five in 1984 and one in 1985. Limiting factors, management strategies, and research objectives for the future will be discussed in light of these changes in status.

California Condor (Gymnogyps californianus) breeding biology.

NOEL F.R. SNYDER (U.S. Fish and Wildlife Service, 1150 Lake Ave., Ojai, California 93023. Phone: 805-649-1168), Helen A. Snyder and Janet A. Hamber (Condor Research Center, 2291A Portola Road, Ventura, California 93003. Phone: 805-644-1766), and Cathleen Cox (Los Angeles Zoo, 5333 Zoo Drive, Los Angeles, California 90027. Phone: 213-666-4650).

Since 1980, efforts have been made to study the reproductive biology of all wild California Condor pairs. Pairs have been observed on a nearly constant daylight coverage basis from distant blinds to determine norms of reproductive behavior and factors affecting reproductive success. A total of 30 nestings has been observed during recent years. Overall reproductive effort of the wild population has been strong in the past few years, although most pairs observed have had difficulties of various sorts, including behavioral problems, poor hatchability of eggs, or other upsets. Two pairs studied in 1981 and 1982 may have been homosexual male-male pairs; no eggs were laid, and all members of the pairs gave typical male displays. Male condors were normally dominant over females in pair interactions. In one pair the extent of male dominance led to recurrent intolerance of the male for his mate and to disruptions in incubation schedules leading to egg loss. Aggressive interactions of a territorial sort between pairs were sometimes quite vigorous, sometimes nonexistent. Nesting territories in recent years have been quite large, with some pairs using alternate nest sites spread over many square miles. Pair bonds have been stable over the years, though repairing has been seen when pair members have disappeared. Age of first breeding was apparently 7 years for one male.

Multiple-clutching of wild California Condors (Gymnogyps californianus).

NOEL F.R. SNYDER (U.S. Fish and Wildlife Service, 1150 Lake Ave., Ojai, California 93023. Phone: 805-649-1168).

Since 1983, most California Condor pairs have been deliberately multiple-clutched to increase productivity of the wild population and to establish a captive population. Of the four pairs from which eggs were taken, three have demonstrated a capacity to lay replacement eggs, and all three have been triple-clutched on one occasion. Only one attempt was made to multiple-clutch the pair that failed to lay replacements. A total of 15 eggs have been artificially incubated to date. Eggs have been transported in incubator suitcases heated with hot-water bottles kept at 96° to 97°F. The normal interval from egg pick-up to the time eggs have been placed in incubators in San Diego has been about 3-4 hours. All eggs have been transported by helicopter. During 1983, eggs were generally left for 3 weeks natural incubation before being taken for artificial incubation. In 1984 and 1985 eggs were taken within 5 days of being laid to maximize the chances of replacements. Hatchability of artificially incubated eggs has been high (93%), as has been the fledging rate (80%), although several chicks would probably not have survived without intensive measures taken by the staff of the San Diego Zoo. The overall multiple-clutching efforts have more than tripled the reproductive rate of the remnant population. Unfortunately, almost all breeding pairs were lost over the winter of 1984-85, so the potentials for future reproductive increases in the wild are now greatly reduced.

Eggshell characteristics of recent California Condors (*Gymnogyps californianus*).

NORL F.R. SNYDER (U.S. Fish and Wildlife Service, 1150 Lake Ave., Ojai, California 93023. Phone: 805-649-1168), Lloyd F. Kiff (Western Foundation of Vertebrate Zoology, 1100 Glendon Avenue, Los Angeles, California 90024. Phone: 213-208-8003), and David B. Peakall (National Wildlife Research Center, Canadian Wildlife Service, Ottawa, Ontario, Canada K1A 0E7. Phone: 819-997-2780).

Recent studies of museum eggs, eggs brought into captivity for artificial incubation, and eggshell fragments found in nests indicate that the California Condor is apparently not suffering from DDE-induced eggshell thinning at the present time. A strong positive correlation has been found between eggshell thickness and egg weight which explains nearly all the variability in eggshell thickness in contemporary eggs and much of the variability in thickness of museum eggs. Nevertheless, eggshell fragments collected in the 1960's were consistently thin; it appears that the population may have been suffering from the DDE syndrome at that time. Direct measurements of DDE concentrations in shell membranes have provided equivocal results, with unexplained factors leading to high variability in replicate determinations. Many cases of historical egg breakage in the species may trace to egg predation by ravens and to accidents, rather than to eggshell thinning.

Study of food habits of the Turkey Vulture by pellet analysis.

CHRISTOS THOMAIDES (Department of Fisheries and Wildlife Sciences, New Mexico State University, Las Cruces, New Mexico 88003. Phone: 505-646-1544), William H. Reid (Department of Biological Sciences, University of Texas at El Paso, El Paso, Texas 79968. Phone: 915-747-5629), Raul Valdez (Department of Fisheries and Wildlife Sciences, New Mexico State University, Las Cruces, New Mexico 88003. Phone: 505-646-3719), and Ralph J. Raitt (Department of Biology, New Mexico State University, Las Cruces, New Mexico 88003. Phone: 505-646-4430).

Casting pellets of Turkey Vultures were collected from a roost in El Paso County, Texas, in June 1980 and June-September 1982. Seventy pellets have been analyzed to date. Mammalian hair and small bone fragments were found in 100% of the pellets, reptilian scutes and small bones in 52.9%, and avian feathers and small bone fragments in 12.9%. Leporid and mustelid hairs were the most often encountered of the hairs examined. The distribution of taxa of the food items in the geographical vicinity of the roost did not reveal any particular foraging habitat preferences by the vultures. Roadkills probably provided the bulk of carrion.

Techniques for captive rearing of California Condors (*Gymnogyps californianus*) from eggs removed from the wild.

C. Kuehler Toone (San Diego Zoo Research Department, P.O. Box 551, San Diego, California 92112. Phone: 619-231-1515 Ext. 450) and WILLIAM D. TOONE (San Diego Wild Animal Park, San Pasqual, California 92025. Phone: 619-747-8702).

The wild population of California Condors is declining. Biologists from the U.S. Fish and Wildlife Service, California Department of Fish and Game, and the National Audubon Society are working together to ensure the

species' survival. A captive population is being developed at the San Diego Wild Animal Park and the Los Angeles Zoo by double-clutching wild breeding pairs. This conservation method is dependent upon successful artificial incubation of eggs and captive rearing of chicks. Based on experience with four other species of New World vultures, in addition to data shared by the Bronx Zoo, Patuxent Wildlife Research Center, and The Peregrine Fund, Inc., the Zoological Society of San Diego developed a protocol for hatching and rearing California Condors. To date, 12 condor chicks have been successfully raised from 15 eggs removed from the wild (hatchability: 87%, survivability: 92%). These birds will form the nucleus of a captive population for future breeding and reintroduction.

Single-sex pairing in captive American Black Vultures (Coragyps atratus).

William D. Toone and DONALD J. STERNER (San Diego Wild Animal Park, San Pasqual, California 92025. Phone: 619-747-8702).

Pairing between birds of the same sex is more common than previously suspected. Gulls, hawks, and other birds have demonstrated this behavior. Observations of three female Black Vultures housed together at the San Diego Wild Animal Park indicates that female-female pairing occurs in New World vultures. Two of these birds paired and harassed the third bird which was subsequently removed from the cage. Although no copulations were seen, the pair courted, laid an egg, and shared incubation duties. Single-sex pair bonds may occur in birds due to limited mate choice. Data from the National Zoo from the early 1900s suggest the possibility that captive female California Condors may have displayed this behavior. Recent field observations show that this behavior may also occur in the wild. Documentation that unisexual pairing occurs in cathartids may have implications from the standpoint of management of small populations of vultures. It may also be a favorable tool when artificial insemination is utilized as a captive management technique.

Natal down sequences in four species of cathartid vultures.

WILLIAM D. TOONE (San Diego Wild Animal Park, San Pasqual, California 92025. Phone: 619-747-8702), Kathie Cox (University of California at San Diego), and Donald Sterner (San Diego Wild Animal Park, San Pasqual, California 92025. Phone: 619-747-8702).

Studies to determine natal down sequences are being conducted on four species of cathartid vultures: Black Vultures (Coragyps atratus), King Vultures (Sarcoramphus papa), Andean Condors (Vultur gryphus), and California Condors (Gymnogyps californianus). This information is being compiled using captive vultures raised at the San Diego Wild Animal Park. These data are compared with information gathered from observations of natal down patterns of birds in the wild. These records will enable researchers to properly characterize the plumage sequence in New World vultures. Documentation of the correct down sequence from the appearance of natal down to juvenile plumage will be useful to vulture field researchers as an age indicator of birds in wild populations. It will also be valuable as a taxonomic characteristic of this group of birds. Plumage sequence comparison can be made between raptors, Old World vultures, New World vultures, and storks.

1985 RAPTOR RESEARCH FOUNDATION

SYMPOSIUM ON THE MANAGEMENT OF BIRDS OF PREY

INTERNATIONAL MEETING

Monday, November 4, Tuesday, November 5
and Wednesday, November, 6
1985 International Peregrine Conference



* ABSTRACTS *

SESSION 4.

INTERNATIONAL PEREGRINE CONFERENCE
TWENTY-YEAR ANNIVERSARY MEETINGNovember 3-6, 1985
Sacramento, California

Hosted by:

The Peregrine Fund, Inc.
Ithaca, New York
Boise, Idaho
Santa Cruz, CaliforniaHeld in conjunction with the 1985 Raptor Research Foundation Symposium
on the Management of Birds of Prey, International Meeting

Sponsored by:

Bureau of Land Management
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The National Audubon Society
Pacific Gas and Electric Company
The Peregrine Fund, Inc.
Southern California Edison Company
San Francisco Zoological Society
U.S. Fish and Wildlife Service
The Western Foundation of Vertebrate Zoology

Status and conservation problems of the Peregrine in Italy.

STEFANO ALLAVENA (Division of Nature Protection, Ministry of Agri. and Forests, Via Carducci, 5, 00100 Roma, Italy).

The latest surveys of the Peregrine population in Italy, including Sicily and Sardinia, clearly indicate more falcons than previously believed, around 430 to 550 pairs. Nesting habitat occurs in the Alps, the Appenines, on islands large and small, and along rocky coasts. The species is infrequent in the Alps but more common in southern Italy, reaching maximum densities on certain rocky coasts and islands. Although density is not high in the long Appenine chain, the Peregrine is found there in good, undisturbed habitat. F. p. brookei is the predominant subspecies in Italy, but in the Alps individuals of both brookei and peregrinus seem to occur. The Italian Peregrine population appears to be stable but is under some threat from nest-robbers, illegal shooting, and habitat deterioration. The robbing is a direct result of an international market for falcons, mostly involving foreigners from the Federal Republic of Germany and parts of the Middle East, with the former serving the latter. Almost equally threatening at present--and probably more so in the future--is habitat destruction in the form of road building especially, and the growing popularity of recreational activities in nature.

Status of Peregrine populations in Alaska since 1965.

R.E. (SKIP) AMBROSE (U.S. Fish & Wildlife Service, 1412 Airport Way, Fairbanks, Alaska 99701), Robert J. Ritchie (Alaska Biological Research, Box 81934, Fairbanks, Alaska 99708), Clayton M. White (Brigham Young University, 574 Widstoe Bldg., Provo, Utah 84602), Philip F. Schempf (U.S. Fish & Wildlife Service, P.O. Box 1287, Juneau, Alaska 99802), Ted Swem and Robert Dittrick (Biological Investigative Research Studies, Box 4-1740, Anchorage, Alaska 99509).

Prior to the 1965 Peregrine conference, little work had been done on Peregrines inhabiting the arctic tundra region and taiga region of Alaska. One exception was the Peregrine population along the Colville River in northern Alaska which was studied intensively by Cade during the 1950's (Cade 1960). Following the 1965 conference, the Colville River population, as well as the upper Yukon River population, was closely examined to determine status and pesticide contamination levels. Studies in the late 1960's had reported populations which were apparently reproducing normally although pesticide levels were dangerously high. It appears now, based on productivity during recent years, that the surveys during the 1960's were observing declining populations. Declines of both F. p. tundrius in northern Alaska and F. p. anatum in interior Alaska continued through the early 1970's declining to approximately 35% and 45% respectively of their historical levels. Intensive surveys since 1979 covering over 2,000 river miles per year have recorded increases of both populations to near normal levels along the major rivers. Surveys of small, isolated populations during the same period have also recorded increases but to a lesser degree. Furthermore, surveys in the Aleutian Islands and southeast Alaska have shown that Alaska's third Peregrine subspecies, F. p. pealei, is an apparently healthy population reproducing at normal levels.

status and conservation problems of the Peregrine in Italy.
STEFANO ALVAREZ (Division of Nature Protection, Ministry of Agriculture and Forestry, Via Cavour, 2, 00100 Rome, Italy).
The latest surveys of the Peregrine population in Italy, including Sicily and Sardinia, clearly indicate more falcons than previously believed, around 250 to 300 pairs. Nesting habitats occur in the Alps, the Apennines, on islands large and small, and along rocky coasts. The species is widespread in the Alps but more common in southern Italy, reaching maximum densities on certain rocky coasts and islands. Although density is not high in the long Apennine chain, the Peregrine is found there in good, undisturbed habitats. E. G. Prager is the predominant subspecies in Italy, but in the Alps individuals of both *prageri* and *italicus* seem to occur. The Italian Peregrine population appears to be stable but is under some threat from nest-robbing, illegal shooting, and habitat destruction. The breeding is a direct result of an international network of falconers, mostly involving falconers from the Federal Republic of Germany and parts of the Middle East, with the former serving the latter. Almost equally threatening to growth--and probably more so in the future--is habitat destruction in the form of road building, especially, and the growing popularity of recreational activities in nature.

Reason of Peregrine population in Alaska since 1965.
R. E. (MRS) ALVAREZ (U.S. Fish & Wildlife Service, 1415 Airport Way, Anchorage, Alaska 99501), Robert L. Alvares (Alaska Biological Research, Box 21224, Anchorage, Alaska 99501), Clayton M. White (Grigam Young University, 744 Alaskan Blvd., Prigo, Utah 84002), Philip T. Coleman (U.S. Fish & Wildlife Service, P.O. Box 1287, Lunenburg, Alaska 99002), Ted Jones and Robert R. (Biological Investigative Research Station, Box 4-1700, Anchorage, Alaska 99502).
Prior to the 1965 Peregrine conference, little work had been done in estimating the breeding population along the Colville River in northern Alaska which was studied intensively by Jones during the 1960's. Following the 1965 conference, the Colville River population, as well as the upper Yukon River population, was intensively examined to determine status and possible conservation levels. Studies in the last 1960's had reported populations which were apparently representing normally although possible levels were dangerously high. It appears now, based on productivity during recent years, that the surveys during the 1960's were observing declining populations. Declines of both E. G. Prager in northern Alaska and E. G. Prager in eastern Alaska continued through the early 1970's resulting in approximately 15% and 25% respectively of total historical levels. Reproductive surveys since 1970 covering over 2,000 river miles per year have recorded increases of both populations to near normal levels along the entire rivers. Surveys of small, isolated populations during the same period have also recorded increases but to a lesser degree. Furthermore, surveys in the Alaskan Islands and northeast Alaska have shown that Alaska's total Peregrine population, E. G. Prager, is an apparently healthy population representing at normal levels.

Alaska Peregrine Falcon productivity in 1984 and the role of organochlorine residues.

Robert E. Ambrose (U.S. Fish & Wildlife Service, 1412 Airport Way, Fairbanks, Alaska 99701), CHARLES J. HENNY (U.S. Fish & Wildlife Service, Patuxent Wildlife Research Center, 480 SW Airport Road, Corvallis, Oregon 97333), and Robin E. Hunter (Department of Fisheries & Wildlife, Oregon State University, Corvallis, Oregon 97331).

Twenty Peregrine Falcon (Falco peregrinus) eggs (one per eyrie) were collected at random in Alaska in 1984 for organochlorine residue analysis. Prior to this study we had obtained only addled eggs which were possibly not representative of the egg-laying population if addled eggs contained different levels of organochlorines than viable eggs that hatched. Ten eggs were collected from the American (anatum) population (8 upper Yukon River, 2 Tanana River) and 10 eggs from the Arctic (tundrius) population were later collected in the study area. Productivity at specific eyries and eggshell thickness were evaluated in relation to residue burdens in sample eggs collected. Residue levels and residue profiles for the two subspecies were compared. The tentative "critical" residue level in Peregrine eggs of 15-20 ppm DDE (wet weight) was compared to results obtained from this study. We also present some data on residue levels in prey species from the study area.

What is the extent of the west coast Peregrine migration?

CLIFFORD M. ANDERSON (1623 6th West, Kirkland, Washington 10024), David G. Roseneau (1758 Army Rd. Fairbanks, Alaska 99701), and Brian J. Walton (Predatory Bird Research Group, Univ. of Calif., Santa Cruz, California 95064).

Recent evidence based on band returns and sightings has confirmed that a migration of Peregrine Falcons occurs along the Pacific Coast of North America in both the spring and fall. The natal origins of ten falcons recovered thus far include Alaska (6), British Columbia (2), the Yukon Territory (1) and the Northwest Territories (1). Three subspecies (F. p. tundrius, F. p. anatum, and F. p. pealei) are represented in this sample. Another immature female Peregrine, banded on 3 October 1985 at the Cape Flattery Peninsula, Washington, was recovered eight days later at Point Mugu, California, 1,100 miles south, the first record of a banded Peregrine migrating down the coast. Two other recoveries demonstrate that at least some Alaskan Peregrines winter near Vancouver, British Columbia, further north than their assumed wintering range. During the last four years on the Washington Coast, several observers have reported small but significant numbers of spring migrant Peregrine Falcons in April and May at Willapa Bay (26 sightings), Gray's Harbor (16 sightings), and the Cape Flattery Peninsula (18-19 sightings). These birds are presumably in route to Alaska from wintering areas in Latin America. An adult Peregrine banded originally on the Colville River in Alaska and recovered in April 1985 on San Miguel Island off the coast of California supports this theory.

Alaska Peregrine falcon productivity in 1985 and the role of organochlorine residues.

Robert E. Anderson, U.S. Fish & Wildlife Service, 1411 Airport Way, Portland, Oregon 97201, Robert A. Went, U.S. Fish & Wildlife Service, Portland Wildlife Management Center, 400 SW Airport Road, Corvallis, Oregon 97331, and David E. Hunter, Department of Fisheries & Wildlife, Oregon State University, Corvallis, Oregon 97331.

Twenty Peregrine falcons (*Falco peregrinus*) were (one per year) were collected at various locations in Alaska in 1985 for organochlorine residue analysis. Prior to this study we had retained only adult eggs which were possibly not representative of the egg-laying population if adult eggs contained different levels of organochlorine than viable eggs that hatched. Two eggs were collected from the Adirondack (Adirondack) population (8 upper Yukon River, 1 female adult and 10 eggs from the Arctic (Arctic) population were later analyzed in the study area. Productivity at specific sites and eggshell thickness were evaluated in relation to residue levels in the eggs collected. Residue levels and residue profiles for the two subspecies were compared. The relative "residue" residue level in Peregrine eggs at 10-15 ppm DDT level was compared to results obtained from this study. We also present some data on residue levels in prey species from the study area.

What is the impact of the west coast Peregrine migration? L. R. BROWN, M. J. BROWN, 11115 4th Ave., Everett, Washington 98201, David E. Anderson, U.S. Fish & Wildlife Service, 1411 Airport Way, Portland, Oregon 97201, and Brian J. Walton, University of California, Davis, California 95616.

Recent evidence based on band returns and sightings has confirmed that a migration of Peregrine falcons occurs along the Pacific Coast of North America in both the spring and fall. The natal origin of the falcons recovered from the Pacific Coast (6), British Columbia (5), the Yukon Territory (1), and the Northwest Territories (1). These subspecies (F. p. anatum, F. p. mexicanus and F. p. peregrinus) are represented in this sample. Another subspecies, *Falco peregrinus*, banded on 1 October 1985 at the Cape Mendocino, Washington, was recovered eight days later at Point Reyes, California, 1,100 miles north, the first record of a banded Peregrine migrating from the west. Two other recovered demonstrates that at least some Alaska Peregrines winter near Vancouver, British Columbia. Further north than these recovered wintering ranges. During the last four years on the Washington Coast, several observers have reported small but significant numbers of spring migrant Peregrine falcons in April and May at Willapa Bay (10-15 sightings), Lewis & Clark (11 sightings), and the Cape Elizabeth Peninsula (10-15 sightings). These birds are presumably in route to Alaska from wintering areas in Latin America. An adult Peregrine banded originally on the Columbia River in Alaska and recovered in April 1985 on San Miguel Island off the coast of California supports this theory.

Restoration of the Peregrine Falcon in the Eastern United States.

JOHN H. BARCLAY (The Peregrine Fund, Inc., Laboratory of Ornithology, 159 Sapsucker Woods Road, Ithaca, New York 14850).

Seven hundred and fifty-two Peregrine Falcons (Falco peregrinus) have been released by hacking or fostering in the Eastern United States during 1975-1985. Successful nesting by released falcons first occurred in 1980 and there has been a steady increase in the nesting population each year. Through 1985 there have been 62 confirmed nesting attempts, 47 (76%) have been successful, and 128 young hatched. Productivity has been 2.06 young per attempt and 2.72 young per successful attempt. Releases have been concentrated in three geographical regions: The mid-Atlantic coastal zone where specially constructed towers and other man-made structures provide nesting sites, and the mountains of New England and the southern Appalachians. The current recovery goal is to establish 20-30 nesting pairs in each of the three regions. A restored population of 60-90 pairs would represent 17% to 26% of the estimated pre-DDT era population (350 pairs) in the eastern United States. The ultimate goal of the Eastern Peregrine Falcon Recovery Plan is to establish a breeding population equal to half the estimated number of pairs present before DDT, or 175 pairs.

DDE residues in eggs and shell characteristics of reestablished Peregrines in Eastern United States.

John H. Barclay and MARTY GILROY (The Peregrine Fund, Inc, Ithaca, New York 14850).

Eggs and shell fragments were collected from reintroduced Peregrine Falcons breeding at nine mid-Atlantic coastal and urban territories between 1981 and 1984. Organochlorine residues and eggshell thickness measurements are compared among years and territories. Shell thickness is compared to that of eggs laid prior to 1947 and to eggs of captive Peregrines from which wild breeders are descendants.

Analyses of fall migration data on Peregrines from Cedar Grove, Wisconsin, 1951-1984.

DANIEL D. BERGER (Cedar Grove Ornithological Station, Cedar Grove, Wisconsin 53013) and Helmut C. Mueller (Dept. of Biology and Curriculum in Ecology, University of North Carolina, Chapel Hill, North Carolina 27514).

Reasonably regular observations and trapping of diurnal raptors have been conducted at the Cedar Grove Ornithological Station since 1951. In many years the station was manned every day during the period when Peregrines migrate. The fall migration of Peregrines at Cedar Grove since the early 1950's has been composed almost entirely of tundrius, and few adults were seen or captured. We will present the results of several analyses which will attempt to use our migration data to comment on population trends in the Arctic. Caution is advised in using these data in this manner, but it appears possible that populations decreased slowly from 1955 through about 1978 and have been increasing since then. Our analyses are incomplete at this time and it is not clear whether or not Peregrines have regained the numbers existing in the early 1950's. Fragmentary data

suggest that Peregrines will not achieve levels existing in the 1930's for some time, if ever. Banding data indicate that Cedar Grove Peregrines come from nests throughout much of the Nearctic (at least Alaska to Hudson Bay), and winter as far as Uruguay.

Peregrine Falcon populations in Ungava Bay, 1980-1985.

DAVID M. BIRD (Macdonald Raptor Research Centre of McGill Univ., 21,111 Lakeshore Rd., Ste. Anne de Bellevue, Quebec H9X 1C0 Canada), and James D. Weaver (The Peregrine Fund, Laboratory of Ornithology, Cornell University, Ithaca, New York 14850).

Except 1983, portions of the Koksoak River, Leaf Basin, and the Payne River were surveyed by canoe and/or helicopter from 1980 to 1985. Up to 30 territories were checked annually for evidence of nesting by Peregrine Falcons. Percentage occupancy remained stable throughout the five years surveyed. The number of young per pair has increased from 2.70 in 1980 to 3.05 in 1985. The number of young per successful pair has increased from 2.70 in 1980 to 3.21 in 1985. A strong case can be made for the use of alternate cliff sites by Ungava Peregrines. In 1985 one cliff yielded three species with young: Peregrine Falcons, Rough-legged Hawk (Buteo lagopus), and Raven (Corvus corax), a highly unusual situation in this region.

Protection and artificial eyrie management for Peregrines in West Germany.

HELMUT BRÜCHER (Arbeitsgemeinschaft Wanderfalkenschutz, Sternenburgstr. 89, D 53 Bonn 1, West Germany).

The German Working Group for the Protection of Peregrines (AGW) was founded 20 years ago in order to protect the remainder of the population of Peregrines in the Federal Republic of Germany. In 1965 there were only 40 breeding pairs left, with a breeding success rate of 30 juveniles per annum; distribution was restricted to southern Germany. The causes of this decline cannot now be reconstructed, although they were most probably pesticides and the taking of nestlings. It is unknown how important these individual factors were: The AGW began its program of protection in 1965 with (a) education work on Peregrines, (b) surveillance of nests to hinder the taking of nestlings or eggs, (c) protection against rock-climbing, and (d) reduction of natural breeding losses. Breeding success was raised considerably by: (1) frightening off predators (martens), (2) treatment of breeding sites and affected nestlings for ecto-parasites (ticks), (3) optimizing breeding sites by drainage of nest depressions, enlargement or modification for protection against rain, ice, and snow, sealing off unsuitable breeding sites, and creating new platforms with artificial nest boxes. Since the private initiative of the AGW with these protective measures began, the population has risen to more than 130 breeding pairs and 200 fledglings in 1985. The Peregrine population in southwest Germany can now be viewed as secure; with the recolonizing by a number of pairs in areas outside the center of present distribution, it can be expected that with the continuation of protective measures, the FRG will, in a few years, once again have a widely distributed Peregrine population. In the region where the AGW has been working, it has not been necessary to release captive-produced falcons to increase the wild population.

Recovery effort for the Peregrine Falcon in the Rocky Mountains.

WILLIAM A. BURNHAM, William Heinrich, Calvin Sandfort, Edward Levine, Daniel O'Brien (The Peregrine Fund, Inc., 5666 West Flying Hawk Lane, Boise, Idaho 83709), and Daniel Konkel (11 Beaver Drive, Sheridan, Wyoming 82801).

The Peregrine Falcon population declined to approximately 10% of numbers once existing in the Rocky Mountain area, and most if not all Peregrines were lost from Montana, Wyoming, Idaho, South Dakota, North Dakota, and northern Utah by the mid-1970's, when preliminary recovery efforts were begun. Between 1973 and 1985 over 900 eggs from Peregrines of Rocky Mountain origin were hatched, primarily at The Peregrine Fund, Inc. facilities. Ninety-three percent of the young which hatched survived, and almost 700 have been released by hacking, fostering, or cross-fostering, in that order of significance. The result is that Peregrines again breed in Montana, northern Utah, Wyoming, and Idaho and have greatly increased in numbers in Colorado. To restore the Peregrine to a population level which should be self-perpetuating through all or most states where it formerly existed will probably require releases for at least another decade. Some shell-thinning continues, but production of young by returning falcons is about 2.5 young/producing pair. The greatest threat to released and returning falcons appears to be predation by Golden Eagles and Great Horned Owls. The success of the recovery effort has resulted from hard work of a core of skilled and determined researchers and from cooperation by both the public and private sector, including industry.

The breeding of Peregrines and other falcons in captivity: A historical summary.

TOM J. CADE (The Peregrine Fund, Inc., Laboratory of Ornithology, Cornell University, Ithaca, New York 14850).

Falcons were probably being bred occasionally in confinement as far back as the 15th Century or earlier, but since Renz Waller raised two broods in Germany during World War II (1942-43), more than 4,000 Peregrine Falcons have been produced in captivity in more than 75 breeding projects, and the propagation of falcons has become a worldwide enterprise. At least 23 species of the genus Falco have been successfully propagated in confinement. An organized interest in propagating Peregrines took root in North America following the Madison Peregrine Conference in 1965 and resulted in the formation of the Raptor Research Foundation, Inc., which helped to promote both private and institutional breeding projects. The first Peregrines were produced in the United States in 1968, and by the early 1970's dozens were being raised each year. While two major, institutional and government supported programs (The Peregrine Fund, Inc. and the Canadian Wildlife Service Program) have been producing hundreds of young Peregrines for release and reestablishment in the wild, private breeders have also made important contributions, not only to the total number of falcons produced but also to the development of improved techniques. In Europe, the Birds of Prey Conservation and Falconry Centre (Newent), the Hawk Trust, the British Falconers' Club, and the Deutscher Falkenorden have all played important roles in developing the captive propagation of falcons and other raptors. In part as a consequence of the recovery in numbers of wild populations and in part as a result of captive breeding, there probably are more Peregrine Falcons in the world now than at any time since World War II.

Recovery efforts for the Peregrine falcon in the Rocky Mountains. William A. Sengstack, William Sengstack, Calvin Sengstack, Edward Lavin, Daniel C. Brien (The Peregrine Fund, Inc., 2000 West Tipton Lane, Boise, Idaho 83705), and Daniel Brien (11 Beaver Drive, Sheridan, Wyoming 82801).

The Peregrine falcon population declined to approximately 10% of numbers once existing in the Rocky Mountains area, and most if not all Peregrines were lost from Montana, Wyoming, Idaho, North Dakota, South Dakota, and Nebraska from 1910 to 1970's, when preliminary recovery efforts were begun. Between 1971 and 1985 over 900 eggs from Peregrines of Rocky Mountain origin were hatched, primarily at The Peregrine Fund, Inc. Twenty-three percent of the young which hatched survived, and almost 100 have been released by hatching, fostering, or cross-fostering in their order of significance. The results in that Peregrines again breed in Montana, North Dakota, Wyoming, and Idaho and have greatly increased in numbers in Colorado. To restore the Peregrine to a population level which should be self-sustaining through all or most states where it formerly existed will probably require release of at least another 1000. Some small-scale operations, but production of young by breeding falcons is about 1-2 young/breeding pair. The greatest threat to released and returning falcons appears to be predation by Golden Eagles and Great Horned Owls. The success of the recovery effort has resulted from part of a mix of skilled and determined researchers and from cooperation by both the public and private sectors, including industry.

The breeding of Peregrines and other falcons in captivity: A bibliography. Summary.

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Factors affecting Peregrine concentrations in coastal areas.

WILLIAM W. COCHRAN (Illinois Natural History Survey, 607 East Peabody Drive, Champaign, Illinois 61820).

Radio tagged migrant Peregrine Falcons were followed to and along Atlantic and Gulf of Mexico coastal areas and over the Atlantic ocean. HY Peregrines turned west at sundown when migrating over the ocean, avoided continuously forested areas, and loitered when they encountered markedly new habitat. In particular geographic areas, each of these behaviors can cause a concentration of HY Peregrines. The Assateague Island, Maryland, area is unique in that all three behaviors would cause HY Peregrine concentration there by a combined factor of the order of 1000:1.

Peregrine Management in Colorado.

GERALD R. CRAIG (Colorado Division of Wildlife, 317 West Prospect, Ft. Collins, Colorado 80521), James H. Enderson (Dept. of Biology, Colorado College, Colorado Springs, Colorado 80903), and Daniel D. Berger (1806 Grevelia St., So. Pasadena, California 91030).

The Peregrine breeding population in Colorado has been intensively monitored since 1972, and recovery efforts have been under way for the past decade. The current recovery strategy employs hacking to reestablish pairs at vacant sites while fostering maintains adequate reproduction of wild pairs until the pesticide contamination problem diminishes. Since 1978, 155 young have been released from hack-sites for a success rate of 84%. It is anticipated that six hack-sites will be operated annually until suitable historic sites are reoccupied. From 1974 through 1985, 192 young have been fostered to wild pairs with a success rate of 78%. During the same period, productivity of unmanipulated breeding pairs averaged 1.3 young per wild pair while fostering increased productivity to 2.7 young per fostered pair. In addition to increasing productivity, we estimate that fostering salvaged 42 eggs which would not have hatched under natural conditions. Future fostering activities will be restricted to those wild females which demonstrated excessive eggshell thinning or difficulty hatching eggs in previous years. Annual monitoring of site occupancy, reproduction, and eggshell condition is essential to determine whether management is required, to evaluate success of the program, and eventually to document population recovery. By 1985, 33% (14) of the known breeding territories were occupied, including 3 previously vacant historic sites, and released falcons comprised 50% (7) of the pairs. If management continues at the same level, it is anticipated that the state recovery goal of 20 breeding pairs should be achieved by 1988. Whether or not the pairs are self-sustaining will depend upon levels of pesticide contamination at that time.

Productivity, pesticides, and management of the Peregrine Falcon in Arizona.

DAVID H. ELLIS (U.S. Fish & Wildlife Service, Patuxent Wildlife Research Center, Laurel, Maryland).

In the decade since research commenced with the Peregrine in Arizona, over 60 sites have been identified which historically or presently are occupied by breeding pairs. Productivity was determined for about 120

Factors affecting Peregrine concentration in coastal areas.
 WILLIAM W. COCHRAN (Illinois Natural History Survey, 607 East Parkway,
 Urbana, Chicago, Illinois 61810).
 While large migratory Peregrine Falcon were followed to and along
 Atlantic and Gulf of Mexico coastal areas and over the Atlantic ocean.
 H. Peregrines turned west at random when migrating over the ocean,
 avoided continuously forested areas, and followed when they encountered
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 1000:1.

Peregrine Management in Colorado.
 GEORGE R. CHASE (Colorado Division of Wildlife, 317 West Prospect,
 Ft. Collins, Colorado 80521), JAMES R. EMMERTON (Dept. of Biology,
 Colorado College, Colorado Springs, Colorado 80903), and RICHARD D. BERGER
 (1808 Grosvenor St., So. Pasadena, California 91060).
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 84%. It is anticipated that six back-alter will be operated annually
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 young have been released to wild pairs with a success rate of 78%. During
 the same period, productivity of unmanipulated breeding pairs averaged 1.3
 young per wild pair while fostering increased productivity to 2.7 young
 per fostered pair. In addition to increasing productivity, we estimate
 that fostering averaged 25 eggs which would not have hatched under natural
 conditions. Future fostering activities will be restricted to those wild
 females which demonstrated extensive eggshell thinning or difficulty
 hatching eggs in previous years. Annual monitoring of site occupancy,
 reproduction, and eggshell condition is essential to determine whether
 management is required, to evaluate success of the program, and eventually
 to document population recovery. By 1985, 324 (14) of the known breeding
 territories were occupied, including 3 previously vacant historic sites,
 and released falcons averaged 80% (7) of the pairs. If management
 continues at the same level, it is anticipated that the state recovery
 goal of 50 breeding pairs should be achieved by 1985. Whether or not the
 goal is self-sustaining will depend upon levels of pesticide control
 action at that time.

Productivity, persistence, and management of the Peregrine Falcon in
 Arizona.
 DAVID R. WELLS (U.S. Fish & Wildlife Service, Patuxent Wildlife
 Research Center, Laurel, Maryland).
 In the decade since research commenced with the Peregrine in Arizona,
 over 60 sites have been identified which historically or presently are
 occupied by breeding pairs. Productivity was determined for about 150

breeding attempts from 1975-85. Almost all sites, for which productivity information is available for two or more years, have hatched young. Average values for fledging success were ca. 1.4 young/attempt for all active sites and ca. 2.3 young/attempt for successful sites. Eggshell thickness values were highly varied, but few samples reflect thinning sufficient to cause reproductive failure, and the population appears to be increasing slightly. Management practices which can further benefit the falcon include: controlling pesticide use, habitat protection, and information management.

Status of Peregrines in the Rocky Mountains and Colorado Plateau.

JAMES H. ENDERSON (Department of Biology, The Colorado College, Colorado Springs, Colorado 80903), Gerald R. Craig (Colorado Division of Wildlife, 317 W. Prospect, Ft. Collins, Colorado 80521), and William A. Burnham (The Peregrine Fund, 5666 West Flying Hawk Lane, Boise, Idaho 83709).

About 131 Peregrine territories were known in the region (New Mexico, Idaho, Montana, Wyoming, Utah, Colorado) in 1975, and surveys had increased these to 204 and 211 in 1984 and 1985 respectively. The occupancy rate of territories by adult pairs in the last two years was about 24%, and about 75% of these pairs produced young. In 1984 and 1985, a total of 66 nesting attempts by successful adult pairs yielded a mean of 2.5 young per pair (1.8 young per pair for all pairs, although occupancy rate is biased upwards where newly found eyries are included. On the Plateau in 1984 and 1985, the minimum number of young nearing flying age was 1.5 young for all pairs ($n = 38$) and 2.1 for successful pairs ($n = 27$). Data for Peregrines in Colorado are adequate to reveal population trends 1973-1985. Eleven historical localities known before 1973 remain ideal for Peregrines. In 1973, 9 were used by adult pairs, 4 in 1977, fewer than 2 in 1979-84, and 3 in 1985. About 19 other localities, found in use by extensive searches after 1974 had occupancy rates by adult pairs between 16-17 in 1977 and 7 in both 1980 and 1982. The increase of yearlings as pair members, and of lone adults on territories supports the conclusion of a population low during 1979-1983. Recent production at 12 territories where we did not intervene was 1.4 young per adult pair holding territory and 2.1 young per successful pair. For the entire region, occupancy rates and reproduction appear best in the southern section on the Plateau. In the central Rockies occupancy is about one-third of normal, and only 6 pairs, including mostly release birds nest in all of northern Utah, Wyoming, Idaho, and Montana where over 84 historical territories are recorded.

Eggshell thinning and DDE residues in Rocky Mountain Peregrines.

JAMES H. ENDERSON (Department of Biology, The Colorado College, Colorado Springs, Colorado 80521), Gerald R. Craig (Colorado Division of Wildlife, 317 W. Prospect, Ft. Collins, Colorado 80521), and Daniel D. Berger (1806 Grevelia St., So. Pasadena, California 91030).

In the period 1973-85 we measured 303 eggshells from 23 localities in Colorado and northern New Mexico. Many shells were from eggs removed as entire clutches from territories where young were later fostered. Average shell thickness, including membranes, of all eggs taken in a given year varied from 0.292 mm ($n = 32$ in 1977 to 0.325 ($n = 26$) in 1982 yielding

19% and 9% thinning, respectively, compared to the pre-1947 mean of 0.359 mm. Since 1982 the average thinning has been constant at about 12%. Within-clutch variation was often as great as 0.045 mm: single eggshells did not predict clutch means. From 1973 to 1977 fewer than 9% of shells obtained had less than 10% thinning; after that roughly one-third of all eggs measured had less than 10% thinning. DDE residues in egg contents were measured when eggs taken in the fostering activity failed to hatch in captivity. Within-clutch variation in DDE was usually less than a few ppm (wet weight basis). DDE averaged (geometric) for clutches 19.6 ppm (n = 22) in 1973-79, 13.4 ppm (n = 3) in 1980, 13.2 ppm (n = 5) in 1981, 19.8 ppm (n = 4) in 1982, and 14.2 (n = 6) in 1983. No pattern between egg DDE residues and locality, age of females, or shell thickness is apparent. Where DDE averaged more than 20 ppm, shell thickness averaged 0.303 mm (n = 26) in individual eggs; and where DDE was less than 12 ppm shells averaged 0.306 mm (n = 18), a difference less than the error of measurement. In general, perhaps 30% to 50% of the shells produced by this population were thick enough to hatch normally in the wild, the remainder at a reduced rate. DDE residues in egg contents are probably related to body levels during yolk deposition; shell thickness, more to DDE intake concurrent with shell deposition. We predict DDE and shell condition will not change much in the near term.

Population turnover in Colorado Peregrines.

JAMES H. ENDERSON (Department of Biology, The Colorado College, Colorado Springs, Colorado 80903), and Gerald R. Craig (Colorado Division of Wildlife, 317 W. Prospect, Ft. Collins, Colorado 80521).

In 1980-85 we photographed nesting adult Peregrines at 11 localities and determined the identity of 12 males and 13 females. Photographs made in 1980 and 1981 of 12 captives verified adults retain unique plumage patterns, especially on the head, which may be used to distinguish individuals. Identities were determined at the same territories in two successive years in 23 cases for males and 34 for females; the same individuals returned in 19 and 26 cases, respectively, yielding turnover rates of 17% and 23%. One male and two females moved to other territories so that males survived one year in 20 of 23 cases and females 28 of 34 cases. The loss rate was therefore 13% for males and 18% for females (ave. = 16%). These rates were maximum because adults not returning or discovered elsewhere may not have died. Maximum loss rates varied between 8% and 27% in different years but were not significant because of small sample sizes. Four adults, including one pair were seen in all six years, three in five years, and three in four successive years. Generally, a loss rate of 16% is lower than that predicted from historical band recovery records, but higher than that reported for a Scottish population.

Reproduction and population density of the Peregrine Falco peregrinus in South Greenland.

KNUD FALK and Søren Møller (Roskilde University, P.O. Box 26, DK-4000 Denmark).

Four years of investigation of a Peregrine population in the southern-most part of Greenland (app. 60-61° N) is presented. The area has been investigated by boat-checking and back-packing, checking almost all

1954 and 52 specimens, respectively, compared to the pre-1947 mean of 0.122 mm. Since 1947 the average thickness has been constant at about 0.122 mm. Within-clutch variation was often as great as 0.042 mm; single eggs of the same clutch varied from 0.107 to 0.177 mm. From 1973 to 1977 fewer than 2% of shells contained less than 10% thinning; after that roughly one-third of all eggs measured had less than 10% thinning. DDE residues in egg contents were measured when eggs failed in the following activity failed to hatch in captivity. Within-clutch variation in DDE was usually less than a few ppm (wet weight basis). DDE averaged (geometric) for clutches 19.6 ppm ($n = 12$) in 1973-74, 13.4 ppm ($n = 3$) in 1980, 13.5 ppm ($n = 2$) in 1981, 19.6 ppm ($n = 4$) in 1982, and 14.2 ppm ($n = 8$) in 1983. No pattern between egg DDE residues and locality, age of females, or shell thickness is apparent. Where DDE averaged more than 20 ppm, shell thickness averaged 0.305 mm ($n = 10$) in individual eggs; and where DDE was less than 12 ppm shells averaged 0.308 mm ($n = 18$), a difference less than the error of measurement. In general, perhaps 20% to 50% of the shells produced by this population were thick enough to hatch normally in the wild, the remainder at a reduced rate. DDE residues in egg contents are probably related to body levels during yolk deposition; shell thickness, more to DDE intake concurrent with shell deposition. We predict DDE and shell condition will not change much in the near term.

Population turnover in Colorado Partridge.
JAMES H. KENNEDY (Department of Biology, The Colorado College, Colorado Springs, Colorado 80903), and CAROL R. CRAIG (Colorado Division of Wildlife, 317 W. Prospect, Ft. Collins, Colorado 80521).
In 1950-52 we photographed nesting adult partridges at 11 localities and determined the identity of 15 males and 15 females. Photographs made in 1950 and 1951 of 12 captures verified adults within single clutches; especially on the head, which may be used to distinguish individuals. Identities were determined at the same localities in two subsequent years in 23 cases for males and 24 for females; the same individuals returned in 19 and 25 cases, respectively, yielding turnover rates of 10% and 14%. One male and two females moved to other territories so that males survived one year in 20 of 23 cases and females 22 of 25 cases. The loss rate was therefore 13% for males and 14% for females (see Table 1). There were no recaptures between adults not returning or discovered alive where they had been dead. Maximum loss rates varied between 0% and 25% in different years but were not significant because of small sample sizes. Four males, including one pair were seen in all six years, three in five years, and three in four consecutive years. Generally, a loss rate of 10% is lower than that predicted from historical band recovery records, but higher than that reported for a Canadian population.

Reproduction and population density of the Peregrine Falcon (*Falco peregrinus*) in Iowa.
JAMES H. KENNEDY and GARY W. MILLER (Iowa State University, Ames, IA 50010).
Four years of investigation of a Peregrine population in the southern-most part of Iowa (approx. 40°N) is presented. The area has been investigated by nest-checking and band-posting, resulting almost all

suitable sites during the four years. Fifty-two sites have been checked, and twenty-one sites have been found occupied. On average these sites are producing 2.67 young per successful pair per year. The population density is estimated to be one pair per 324 km². No pesticide analysis is yet available, but eggshell thinning is estimated at 17.7% compared to pre-DDT museum eggs.

DDE, productivity, and shell thickness relationships within the genus Falco.

R.W. FYFE (Canadian Wildlife Service, Edmonton, Canada), R.W. Risebrough (Bodega Bay Institute, University of California, Bodega Bay, California), J.G. Monk, W.M. Jarman, B.J. Walton (Predatory Bird Research Group, The Peregrine Fund, Inc., Santa Cruz, California), L.F. Kiff (Western Foundation Vertebrate Zoology, Los Angeles, California), and W. Walker II.

DDE levels in eggs of Prairie Falcons and Merlins breeding in Alberta and of Peregrine Falcons breeding in California are related to productivity and eggshell thickness. The analyses are not complete at the time of preparation of this abstract, but the preliminary results suggest that among these species the Prairie Falcon is the most sensitive to the effects of DDE. Our data are compared with the published DDE - productivity - eggshell thickness data on these and other species of the genus Falco. The data are also used to address the respective hypotheses that the relationships between DDE levels and both thickness and productivity are logarithmic or that they are "S"-shaped, indicating "no-effect" levels of DDE.

Midwest and northern Canadian Peregrine populations.

RICHARD FYFE (Canadian Wildlife Service, Dept. of Environment, 1000, 9942-108 St., Edmonton, Canada, T5K 2I5).

Following the Madison Conference population surveys were carried out in much of the known range of the anatum and tundrius subspecies in the Canadian prairie provinces and Northwest Territories to determine the status of these populations. Initial surveys suggested that anatum populations had either declined sharply or were declining in the prairie regions and in the boreal forest. In contrast tundrius populations appeared to have variable levels of contamination and apparently were just beginning to be affected. Surveys of these populations have been carried out at regular five-year intervals beginning in 1970 and indicate that although the decline continued into the 1970's, northern populations have either stabilized or appear to be recovering. This is particularly true for tundrius. Southern populations remain at very low levels despite continuing releases into this population.

available since during the last years. Fifty-two sites have been checked, and twenty-one sites have been found occupied. On average there are 2.5 young per successful pair per year. The population density is estimated to be one pair per 15 km². No possible analysis is yet available, but eggshell thinning is estimated at 17.5% compared to pre-1967 museum eggs.

DDE, productivity, and shell thickness relationships within the genus *Falco*.

M.V. FINE (Canadian Wildlife Service, Edmonton, Canada), R.W. Blackmore (Ecology Department, University of California, Berkeley, California), L.G. Frank, W.M. James, B.J. Wilson (University of California, Davis, California), L.W. Hill (University of California, Los Angeles, California), and W. Wilson II.

DDE levels in eggs of Prairie Falcons and Westerns breeding in Alberta and of Peregrine Falcons breeding in California are related to productivity and eggshell thickness. The analysis was not complete at the time of preparation of this abstract, but the preliminary results suggest that among these species the Prairie Falcon is the most sensitive to the effects of DDE. Our data are compared with the published DDE - productivity - eggshell thickness data on these and other species of the genus *Falco*. The data are also used to address the respective hypotheses that the relationships between DDE levels and both thickness and productivity are logarithmic or that they are "U-shaped", indicating "no-effect" levels of DDE.

Western and northern Canada's Prairie Provinces, Dept. of Environment, 1980, 1981-82, 1983-84, 1985-86, 1987-88, 1989-90, 1991-92, 1993-94, 1995-96, 1997-98, 1999-00.

Following the Hudson Bay population surveys were carried out in 1980, 1981, 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 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Canadian Peregrine releases.

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Canadian anatum Peregrine reintroductions were initiated in 1975 as experimental releases in western Canada. These have continued and increased annually to the present time with more than 500 birds released in eight provinces and two territories. Releases have been carried out at historical breeding sites, in urban areas by hacking, fostering, and experimentally through cross-fostering. All releases have been of anatum stock produced in captivity at both private and Government breeding facilities.

Dynamics of founder populations established by reintroduction.

J.W. GRIER (North Dakota State University, Fargo, North Dakota) and J.H. Barclay (The Peregrine Fund, Inc., 159 Sapsucker Woods Road, Ithaca, New York 14850).

Reintroduction of Peregrine Falcon populations during the past decade in various geographical areas are contrasted with each other and compared with stochastic and deterministic predictions. Predicted and actual growth of the populations have been in close agreement. Further predictions are made for the future of these populations. As the populations become larger, their growth and chances for continued existence become less stochastic and more deterministic and predictable.

Organochlorine pesticides in plasma of migrating Peregrine Falcons at Padre Island, Texas, Spring 1978-80 vs. Spring 1984.

CHARLES J. HENNY (U.S. Fish & Wildlife Service, Patuxent Wildlife Research Center, 480 SW Airport Road, Corvallis, Oregon 97333), Kenton E. Riddle (University of Texas Cancer Center, Bastrop, Texas 78602), and Craig S. Hulse (U.S. Fish & Wildlife Service, Patuxent Wildlife Research Center, Laurel, Maryland 20708).

A spring concentration of migrating Peregrine Falcons (Falco peregrinus) was first discovered at Padre Island, Texas, in April 1978. The birds were first captured and blood-sampled for monitoring residue burdens and trends in the late 1970's. Only 29 Peregrines were sampled in 1978 and 1979, but 111 were sampled in 1980. The initial investigation showed that DDE in the plasma of spring migrants returning from Latin America for the first time declined significantly during the study (through 1980). In the spring of 1984, 48 Peregrines were captured at Padre Island with blood samples again collected. This report will compare plasma residue data from the earlier study with residues obtained in 1984.

Canadian Peregrine falcons.
 RICHARD TYE (Canadian Wildlife Service, Dept. of Environment, 1980,
 9745-108 St., Edmonton, Canada, T6E 2E2)
 Canadian Peregrine falcon reintroductions were initiated in 1975 as
 experimental releases in western Canada. These have continued and
 increased annually to the present time with more than 500 birds released
 in eight provinces and two territories. Releases have been carried out at
 historical breeding sites, in urban areas by banding, fostering, and
 experimentally through cross-fostering. All releases have been of aging
 stock produced in captivity at both private and Government breeding
 facilities.

Dynamics of feral populations established by reintroduction.
 J.W. GRIER (North Dakota State University, Fargo, North Dakota) and
 J.H. BARNES (The Peregrine Fund, Inc., 139 Spangher Woods Road, Ithaca,
 New York 14850).
 Reintroduction of Peregrine falcon populations during the past decade
 in various geographic areas are contrasted with each other and compared
 with stochastic and deterministic predictions. Predicted and actual growth
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Organochlorine pesticides in plasma of migrating Peregrine falcons at
 Padre Island, Texas, Spring 1978-80 vs. Spring 1984.
 CHARLES E. SMITH (U.S. Fish & Wildlife Service, Patuxent Wildlife
 Research Center, and M. ALBERT BEND, Corvallis, Oregon 97331, KATHLEEN E.
 RIDDLE (University of Texas Cancer Center, Houston, Texas 77030), and
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 60% in the plasma of young migrants returning from Latin America for the
 first time declined significantly during the study (through 1980). In the
 spring of 1984, 44 peregrines were captured at Padre Island with blood
 samples again collected. This report will compare plasma residue data
 from the earlier study with residues obtained in 1984.

The present status and conservation of the Peregrine Falcon in Spain.

BOJA HEREDIA (Museo Nacional de Ciencias Naturales, José Gutiérrez Abascal 2, 28006 Madrid, Spain), L.M. González, J.L. González (Unidad de Zoología Aplicada, Dept. de Ecología, Comunidad Autónoma de Madrid, El Encin, Alcalá de Henares, Madrid, Spain), and Fernando Hiraldo (Museo Nacional de Ciencias Naturales--see above).

Spain holds nowadays the most important breeding population of Peregrine Falcons in Europe, with 65% of the overall number on the continent. An attempted survey has given 1300-1500 breeding pairs with an 80% coverage of the country. Data have been gathered from the literature, oral communication, and personal observations. The Peregrine is widely distributed from high mountains to the coast, showing highest densities (up to 1 pair per 3.5 km) in the Castillian Plateau where the falcons breed in the river crags and hunt in the surrounding agricultural fields. Good breeding densities are found in the Cantabrian and the Mediterranean coasts, while lower densities occur in high mountains and the southern Sierras of Extremadura and Andlucia. This population has shown a marked decline in the last 15 years. In central west Spain a 45% decrease of fledged young was found between 1969-1973. In Aragon (N.E. Spain) a 50% decrease in breeding pairs has been documented between 1965-1980. Main reasons for this decline are: 1) nest robbing (in areas close to large cities 70-80% of the nests are robbed, the young being used for falconry); 2) direct persecution by pigeon fanciers (in eastern Spain trappers are hired to exterminate falcons); and 3) although not proved, pesticide contamination is probably affecting the breeding population. Suggested measures to stop the Peregrine decline include: 1) management of the wild population in areas where the species has decreased significantly; 2) establishment of a captive breeding program to provide birds to falconers; 3) direct surveillance of the eyries in certain river valleys to prevent robbing; and 4) further research of the influences of pesticides.

The Peregrine Falcon population crash in eastern North America.

JOSEPH J. HICKEY (University of Wisconsin, Madison, Wisconsin).

In the early 1940s some 44 Peregrine eyries were being studied in eastern Pennsylvania, New Jersey, southern New York, and Massachusetts by J.N. Rice, R.A. and K.G. Herbert, and J.A. Hagar. Other eyries in northern New England and New York state were less intensively checked by W.R. Spofford. Falconers had not yet fully caught on to the fall flight of Peregrines along the Atlantic coast, and Rice observed that 43% of the eyasses in his region were taken for falconry in 1937-1941. The exploitation was less along the Hudson, and in Massachusetts it amounted to only two young taken from a state park. Yet the Pennsylvania birds produced 1.25 young annually per occupied site in 1939-1946, and the Hudson River birds were at an all-time high in 1947 when a pair was even nesting on Fifth Avenue in New York City. It was at this point that the most extraordinary population crash in the history of ornithology began to take place: In California, Massachusetts, and Britain, female Peregrines began to lay thin-shelled eggs, break them accidentally, and eat their contents. It took years to recognize this unbelievable phenomenon, but it clearly started at these three places in 1947 and at a Montreal skyscraper in 1948. Not all Peregrines were affected at once: Hagar's birds produced young until at least 1951, the Montreal birds until 1952, and some of Spofford's birds until 1956-1957. The actual crash reduced the adults to

The present status and conservation of the Peregrine Falcon in Spain. BOJA HERNANDEZ (Museo Nacional de Ciencias Naturales, José Gutiérrez Abascal 2, 28002 Madrid, Spain), J.M. Gonzalez, J.L. Gonzalez (Unidad de Zoología Aplicada, Dept. de Ecología, Universidad Autónoma de Madrid, E-28002 Madrid, Spain), and Fernando Naveira (Museo Nacional de Ciencias Naturales--see above).

Spain holds nowadays the most important breeding population of Peregrine Falcons in Europe, with 55% of the overall number on the continent. An attempted survey has given 1100-1500 breeding pairs with an 80% coverage of the country. Data have been gathered from the literature, oral communication, and personal observation. The Peregrine is widely distributed from high mountains to the coast, showing highest densities (up to 1 pair per 3.5 ha) in the Castilian Plateau where the falcons breed in the river crags and hunt in the surrounding agricultural fields. Good breeding densities are found in the Cantabrian and the Mediterranean coasts, while lower densities occur in high mountains and the southern border of Extremadura and Andalusia. This population has shown a marked decline in the last 15 years. In central-west Spain a 50% decrease of fledged young was found between 1966-1977. In Aragón (N.E. Spain) a 50% decrease in breeding pairs has been documented between 1965-1980. Main reasons for this decline are: 1) nest robbing in areas close to large cities 10-50% of the nests are robbed, the young being used for falconry; 2) direct persecution by illegal falconers (in eastern Spain traps are also to exterminate falcons); and 3) although not proved, pesticides contamination is probably affecting the breeding population. Suggested measures to stop the Peregrine decline include: 1) management of the wild population in areas where the species has increased slightly; 2) establishment of a captive breeding program to provide birds to falconers; 3) direct surveillance of the species in certain river valleys to prevent robbing; and 4) further research of the influence of pesticides.

The Peregrine Falcon population crash in eastern North America. JOSEPH J. MAYER (University of Wisconsin, Madison, Wisconsin). In the early 1970s some 25 Peregrine falcons were being studied in eastern Pennsylvania, New Jersey, southern New York, and Massachusetts by J.W. Hines, R.A. Hickey, and R.E. Berberich, and J.A. Hagar. Other studies in northern New England and New York state were later intensively checked by W.E. Spotted. Peregrines had not yet fully caught on to the fall flight of Peregrines along the Atlantic coast, and Hines observed that 4% of the species in his region were taken for falconry in 1977-1981. The rapid falcon was lost along the Hudson, and in Massachusetts it was noted in only two young taken from a single pair. Yet the Pennsylvania birds produced 1.25 young annually per breeding pair in 1979-1980, and the Hudson River birds were 4% an all-time high in 1987 when a pair was even nesting on Fifth Avenue in New York City. It was at this point that the most extraordinary population crash in the history of ornithology began to take place. In California, Massachusetts, and Britain, female Peregrines began to lay thin-shelled eggs, broke soon spontaneously, and eat their contents. It took years to recognize this worldwide phenomenon, but it clearly started at those three places in 1997 and at a Montreal airport in 1998. Not all Peregrines were affected as shown: Hagar's birds produced young until at least 1991, the Montreal birds until 1995, and some of Spotted's birds until 1997-1998. The actual crash reduced the adults to

zero on the Hudson in 1958 and in Pennsylvania by 1960. The Massachusetts birds lasted as single males at least to 1957. The mechanics of the decline were: first failure to hatch eggs, then failure to lay, and finally desertion of the site by one or both birds. Some reminiscences of the 1965 Peregrine Conference are also included.

Breeding and feeding behavior of the Peregrine Falcon in Guayllabamba, Ecuador.

NANCY HILGERT (Dept. Biologia, Pontificia Universidad Catolica del Ecuador, Casilla 2184, Quito; Ecuador).

Ortiz recorded the first nesting evidence of Peregrine Falcons in Ecuador in 1979. Two fledged young in February, 1979 and one subadult in March, 1980 were observed (Jenny et al., Condor 83:387, 1981), indicating that eggs had been laid in late December or early January. In October, 1981 a nesting pair was found at the same location described by Jenny. Since then breeding has been recorded in October, 1981 (three eggs), July 1984 (four eggs) and June 1985 (eggs unknown, three young fledged in August); the pair did not breed in 1983, but copulation was observed during all the year. It has been observed that the main source of food during the breeding season is the Eared Dove (Zenaida auriculata), an abundant species in the region. From the available information, it appears that Ecuadorean Peregrines nesting within a few minutes of the equator may lay almost any time of the year, or not at all, depending on circumstances.

Nesting Peregrines in the Chihuahuan Desert of North America.

W. GRAINGER HUNT (Biosystems Analysis, Inc., 303 Potrero St., Suite 29-301, Santa Cruz, California 95060), James H. Enderson (Biology Department, Colorado College, Colorado Springs, Colorado 80903), Brenda S. Johnson (Department of Zoology, University of California, Davis, California 95616), Dirk Lanning, and Devora Ukrain.

We found nesting Peregrines at nine territories in western Texas during the past 12 survey years. Occupancy and reproductivity were good during the late 1970's, but have recently declined. Peregrines breeding in the Sierra Madres of Mexico have shown lower than normal reproduction. DDE levels in recent collections of songbirds in western Texas are alarmingly high.

Fifteen years of study and protection of the Peregrine Falcon in the Jura Mountains of Switzerland.

MICHEL JUILLARD (Laboratoire de Biologie, Lycee Cantonal, CH-2900 Porrentruy).

By the beginning of 1960, the population of the Peregrine Falcon began to decrease in the territory of Switzerland in an alarming way. If sometime a decrease of population can be caused by a cyclic biological phenomenon, the rapid decrease in the number of birds of that period is certainly due to the massive utilization of chemical pesticides, especially DDT. On the other hand, the reality of the disappearance in a more or less short period of time of this raptor in central Europe caused a

zero on the Hudson in 1958 and in Pennsylvania by 1960. The Massachusetts birds lasted as single males at least to 1957. The mechanics of the decline were: First failure to hatch eggs, then failure to lay, and finally desertion of the site by one or both birds. Some consequences of the 1957 Peregrine Conference are also included.

Breeding and feeding behavior of the Peregrine Falcon in Hungary.

Author: HARRY WILSON (Dept. Biology, Portland University, Oregon, U.S.A.).

Orion recorded the first nesting evidence of Peregrine Falcons in Canada in 1979. Two fledged young in February, 1979 and one subadult in March, 1980 were observed (Jenny et al., *Condor* 83:387, 1981). In October, that year two pairs in late December or early January. In October, 1981 a nesting pair was found at the same location described by Jenny. Since then breeding has been recorded in October, 1981 (three eggs), July 1982 (four eggs) and June 1983 (eggs unknown). Three young fledged in August; the pair did not breed in 1983, but occupation was observed during all the year. It has been observed that the main source of food during the breeding season is the Lined Dove (*Streptopelia risoria*), an abundant species in the region. From the available information, it appears that Peregrine Falcons nesting within a few minutes of the equator may lay almost any time of the year, or not at all, depending on circumstances.

Nesting Peregrines in the Chihuahuan Desert of North America. W. L. BROWN (Wetland Systems Analysis, Inc., 103 Potrero St., Suite 22-501, Santa Cruz, California 95060), James H. Anderson (Wildlife Department, Colorado College, Colorado Springs, Colorado 80903), Brenda E. Johnson (Department of Zoology, University of California, Santa Barbara, California 93106), Eric Lanning, and David Harris.

We found nesting Peregrines at nine territories in western Texas during the past 10 survey years. Occupancy and reproductive success during the late 1970's, but have recently declined. Peregrines breeding in the State of Texas have shown lower than normal reproduction. 502 birds in recent collections of eggs in the western Texas are significantly high.

Factors of (a) and protection of the Peregrine Falcon in the Alps Mountains of Switzerland.

Author: RICHARD J. BULL (Laboratoire de Biologie, Lyon, France, CH-69000).

By the beginning of 1980, the population of the Peregrine Falcon began to decrease in the territory of Switzerland in an alarming way. It is estimated that a decrease of population can be caused by a rapid decline in the number of birds of that period in the Alps. On the other hand, the result of the disappearance in a more or less short period of time of this species in central Europe caused a

vast nest robbing of eyries in the regions where numbers of birds remained. After realizing the systematic destruction in the area of the Doubs Gorge region, the SSNPP decided ornithologists of the National Science Society should prevent the destruction of the last wild reproductive pairs. With the help of the federal authorities and a few states, of the Fond d'intervention pour les Rapaces, Organisation Suisse and the various associations for the protection of nature as the WWF of Switzerland, the Swiss League (LSPN) and the Brunette Foundation for the Protection of Nature, they organized a regular patrol of the occupied nests and forced the sterile pairs to a second laying of eggs. The results obtained after 15 years of efforts are encouraging as we assist today a spectacular recolonization of the chain of Jura by this bird. From one breeding pair known in 1970, the population has increased to more than 100 pairs in 1985. Therefore, the Peregrine Falcon is no longer considered as a bird in grave danger in our country. Nevertheless, the reappearance of the Eagle Owl, Bubo bubo, in the same biotope as the Peregrine, following sometimes thoughtless release of owls, may eventually endanger the future of breeding pairs of this falcon.

The Shaheen Falcon, Falco Peregrinus peregrinator Sundevall in the Indian Subcontinent.

T. SURESH KUMAR (Raptor Research Centre, 7-1, Chaitanyapuri P.O. P&T Colony, Hyderabad 500 660, India).

A general survey was made and information was collected on Falco peregrinus peregrinator from various parts of India. Information on the illegal trapping and selling of these birds in recent years is considered. The method used in catching these birds is illustrated in detail. Trapped birds were kept in cages after stitching their eyelids together. Later these birds were taken possibly to Bombay, Calcutta, or other port cities and transported illegally along with pet birds. Reports say that usually birds were taken via sea route and sometimes by air. Conservation measures are described.

Reintroducing the Peregrine Falcon in Sweden.

PETER LINDBERG (Dept. of Zoology, University Göteborg, Box 250 59, S-40031, Göteborg, Sweden).

A captive breeding program was initiated in Sweden in 1974 with the main aim to reintroduce Peregrines in SW Sweden and partly to reinforce declining populations in other areas of Fennoscandia. The program is under development, and the first goal is to release 200 falcons during a ten-year period in SW Sweden. The natural population in this area declined from 62 pairs in 1955 to 1 in 1975. A release of 200 falcons may result in a population of 32 breeding pairs after 15 years using the following survival and production parameters: So (1st yr) 40%, S (subseq. yrs) 80%, production 1.5 young/breeding attempt and breeding at 2 years. Effects of inbreeding, chance, and dispersal on small populations are discussed. The captive population involves 50 falcons, of which ca. 50% are unrelated. Only birds of subsp. F. p. peregrinus originating mainly from Fennoscandia will be released. Of 14 females older than 4 years, 7 have produced young (1985)--5 by natural copulation and 2 by artificial insemination. In 1978-85 a total of 218 eggs were laid (11 females) of which 89 were fertile

(hatchability 76%) resulting in 64 young; 30 young were fostered to wild birds, 16 released by hacking, and 18 kept in captivity. In 1985 at least seven wild pairs made breeding attempts in SW Sweden and SE Norway (adjoining the release-area). In three pairs color-ringed birds released 1982-83 were observed.

The Peregrine Falcon (Falco p. peregrinus) in Fennoscandia.

PETER LINDBERG (Dept. of Zoology, University Göteborg, Box 25059, S-40031, Göteborg, Sweden), Peter J. Schei (Ministry of Environment, Myntgat. 2, Oslo Dept. Oslo 1, Norway), and Marcus Wikman (Finnish Game and Fisheries Research Institute, Pitkäsillanranta 3 A, SF-00530 Helsinki, Finland).

The pre-1940 population of Peregrines in Norway, Sweden and Finland has been estimated at 2000-3500 pairs, with high densities in SW Sweden (1 pair/140 sq.km), coastal areas of Norway, and on bogs in N Finland. The main population was cliff-nesting, but 15%-20% of the total Fennoscandian population bred on bogs in N Finland. Main decline started in the early 1950s correlating with increased use of OCs and HG. The rate of decline differed for different areas probably owing to the food choice and wintering areas. The Finnish population declined with an annual rate of ca. 20% during the 1960s, but the decline levelled off to some 5% annually during the early 1970s. The Peregrine was extirpated from large areas in S and C Sweden, S Finland and S Norway by 1970. The rapid decline occurred as an effect of both increased adult mortality (use of cyclodienes in wintering areas in W Europe) and lowered reproduction (eggshell thinning). The population probably reached its lowest level around 1975 (total known population ca. 65 pairs). Since then a slight increase has occurred especially in Norway and N Finland (pop. size 120-150 pairs). Increased survival owing to hunting regulations in winter quarters as well as lowered pesticide exposure due to ban and restriction of OCs and Hg in Fennoscandia and many other European countries may explain the positive trend. Monitoring of Hg and OCs in eggs and feathers has revealed declining levels, although levels of OCs in the 1970s were the highest recorded in Europe. While the N Fennoscandian population is increasing, the remaining population in S Scandinavia still seems to be in trouble.

Migration, nest-site fidelity, and mortality of Fennoscandian Peregrines based on ringing recoveries.

PETER LINDBERG (Dept. of Zoology, University of Göteborg, Box 25059, S-40031 Göteborg, Sweden).

In the period 1914-1984 about 2155 Peregrines were ringed as nestlings in Fennoscandia. About 50% of the birds were ringed in Sweden before 1955. The recovery rate was 20% before 1965 with 48% of the birds reported as shot or killed. The recovery rate decreased to about 6% in 1975-1984, probably reflecting a lowered shooting pressure in the winter quarters of Holland, Belgium and France. First year birds suffered an extremely high mortality in August-October, the period coinciding with independence, autumn migration, and opening of the duck hunting season. Birds 1-2 years had the highest mortality during winter, and birds older than 2 years most

(Hatchability 50%) resulting in 64 young; 30 young were lost to wild birds, 18 released by hand, and 16 kept in captivity. In 1981 at least seven wild pairs made breeding attempts in SW Sweden and SE Norway (adjacent to the release areas). In other pairs colour-ringed birds released 1981-82 were observed.

The Peregrine Falcon (*Falco p. peregrinus*) in Fennoscandia.
 PETER LINDBERG (Dept. of Zoology, University of Göteborg, Box 1007, S-40031, Göteborg, Sweden), Peter J. Stadel (Ministry of Environment, Myrnes, 2, Oslo 1, Norway), and Kari Stadel (Finnish Game and Fisheries Research Institute, Pitkämäentie 2 A, SF-00230 Helsinki, Finland).

The pre-1980 population of peregrines in Norway, Sweden and Finland has been estimated at 1000-1500 pairs, with high densities in SW Sweden (1 pair/km² at least), coastal areas of Norway, and on hills in N Finland. The main population was self-sustaining, but 15-20% of the total Fennoscandian population bred on hills in N Finland. Main declines started in the early 1950s coinciding with increased use of GCS and HG. The rate of decline differed for different areas probably owing to the food chain and wintering areas. The Finnish population declined with an annual rate of c. 20% during the 1950s, but the decline levelled off to some 5% annually during the early 1970s. The peregrine was extirpated from large areas in S and E Sweden, S Finland and S Norway by 1970. The rapid decline occurred as an effect of both increased adult mortality (loss of experienced birds) and increased reproduction (eggs and young). The population probably reached its lowest level around 1975 (total known population c. 60 pairs). Since then a slight increase has occurred especially in Norway and N Finland (pop. also 150-200 pairs). Increased survival owing to hunting regulations in winter quarters as well as increased pesticide exposure due to ban and restriction of GCS and HG in Fennoscandia and many other European countries may explain the positive trend. Monitoring of HG and GCS in eggs and foodstuffs has revealed declining levels, although levels of GCS in the 1970s were the highest recorded in Europe. While the N Fennoscandian population is increasing, the remaining population in S Scandinavia still seems to be in trouble.

Migration, nest-site fidelity, and mortality of Fennoscandian Peregrines based on ringing recoveries.

PETER LINDBERG (Dept. of Zoology, University of Göteborg, Box 1007, S-40031 Göteborg, Sweden).

In the period 1975-1980 about 2150 Peregrines were ringed as nestlings in Fennoscandia. About 50% of the birds were ringed in Sweden before 1977. The recovery rate was 100% before 1980 with 40% of the birds reported as shot or killed. The recovery rate decreased to about 50% in 1975-1980, probably reflecting a lowered shooting pressure in the winter quarters of Holland, Belgium and France. First year birds suffered an extremely high mortality in August-October, the period coinciding with independence, autumn migration, and opening of the duck hunting season. Birds 1-2 years old had the highest mortality during winter, and birds older than 2 years most

frequently died in the breeding season (shot on breeding place); 65% of the breeding season recoveries of birds older than 2 years were found within a distance of 99 km from the hatching place. Survival values were estimated in deterministic and stochastic life-tables. Limitations in using recoveries for survival calculations are discussed.

Identification and development of breeding population-specific DNA polymorphisms within the genome of Falco peregrinus.

JONATHAN L. LONGMIRE (Genetics Group, Life Sciences Div. Los Alamos Nat. Lab., Los Alamos, New Mexico 87545).

In order to facilitate population-of-origin determinations to be performed upon individuals captured during migration or at wintering sites, we have initiated a study to identify breeding population-specific restriction fragment length polymorphisms within the genome of the Peregrine Falcon. High molecular weight DNA (isolated from small quantities of peripheral blood) is analyzed for polymorphic loci using several established molecular biological techniques, including restriction endonuclease digestion, agarose gel electrophoresis, southern transfer, and hybridization to radio-labeled gene-probes. Initial results obtained from ongoing analyses of DNA isolated from migratory Peregrines, as well as specimens of known geographic origin, demonstrate these birds to be polymorphic at the genomic level. Future goals are to identify and develop a large number of heritable variant loci as breeding population-specific markers. Such markers, once established, will greatly enhance the ability to investigate several aspects of Peregrine biology, including population dynamics, outbreeding rates, migratory patterns, and the possible existence of population-specific wintering sites. (Supported by the Los Alamos National Laboratory.)

The Greenland Peregrine Falcon Survey, 1972-1985, with emphasis on recent population status and trends.

WILLIAM G. MATTOX (Greenland Peregrine Falcon Survey, Box 29403, Columbus, Ohio).

Fourteen annual field surveys have been conducted in an area near inner Søndre Strømfjord, extending to the outer coast in recent years. The survey has now banded over 400 Peregrine Falcons in the area. In recent years, adults have been captured at the nest site to provide data on adult population dynamics heretofore unavailable for Greenland. Of 358 falcons banded through 1984, 24 have been recovered (7%), of which only 5 had been shot or found dead (1.67%). Recovery locations indicate autumn migration along eastern Canada and United States, with alternate paths in central USA (Mississippi River), and Texas Gulf coast. Several spring recoveries hint at a northward return from South America through the Texas Gulf coast and west-central Colorado (Gunnison). Production of young averaged 2.79 per producing pair (1972-1984) with maximums in 1976, 1980, 1983, and 1984; the minimum was in 1977 (2.25). Cliff occupancy has ranged from 50% (1977) to 85% (1984). Number of young produced for all pairs averaged 2.32 in recent years (1982-1984), with a noticeable upward trend of young produced per cliff visited. The population appears healthy and stable, if not showing an upward trend in the past five years.

Typically died in the breeding season (about on breeding phase) 45% of the breeding season recoveries of birds older than 2 years were found within a distance of 50 km from the breeding phase. Survival values were estimated in deterministic and stochastic life-tables. Limitations in using recoveries for survival calculations are discussed.

Identification and development of breeding population-specific DNA polymorphisms within the genome of *Falco peregrinus*.
JOHANNES L. LOMSTEN (Genetics Group, Life Sciences Div., Los Alamos Nat. Lab., Los Alamos, New Mexico 87545).

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WILLIAM G. MATTHEW (Greenland Peregrine Falcon Survey, Box 19902, Columbus, Ohio).

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Summary of known distribution and status of Peregrines in South America.

J.W. MCNUTT (Department of Psychology, University of California, Davis, California), C. Perez Garat (1021 Montevideo, 1646 Buenos Aires, Argentina), D.H. Ellis (Institute for Raptor Studies, Oracle, Arizona), and C.M. White (Department of Zoology, Brigham Young University, Provo, Utah).

A brief historical review of the literature regarding Peregrines in South America is presented and is complemented with data from recent observations of nesting Peregrines. Currently, information regarding Falco peregrinus cassini comes principally from the two southernmost countries, Argentina and Chile. Recent field studies showed that "Falco kreyenborgi" is a color phase of F. p. cassini. Data are also presented for a few sites in Peru and as far north as Ecuador. Based on these productivity data and sample densities, we tentatively conclude that the South American population of Peregrine Falcons is both larger and more extensively distributed geographically than heretofore estimated.

The come-back of the Peregrine in West Germany.

TH. MEBS (Schwalbengrund 43, D-4630 Bochum 1, West Germany).

In 1970 only about 75 pairs were left of some 400-430 breeding pairs of Peregrines which had lived in West Germany in 1950. The surviving populations of about 35 pairs each were living in Baden-Württemberg and in Bavaria, mainly in the Alps. In the northern half of West Germany the breeding population was extinct in 1970. Until the first half of the 1970's, frighteningly high levels of biocides were found, especially of DDE, HCB and PCB. Since then a decline of the contamination with DDE and HCB has occurred, after their use was prohibited, but PCB residues show an increase. Two activities have helped to increase the number of nesting pairs: In Baden-Württemberg and in Bavaria special groups watch the Peregrine eyries day and night against disturbances by human beings and natural predators. As a result of these untiring activities--and probably of the lesser contamination with biocides--the Peregrine population in Baden-Württemberg stood at more than 80 breeding pairs with more than 120 young in 1984. Also, in the years 1977-1984 the Deutscher Falkenorden (German Falconers' Association) released 191 young captive-produced Peregrines, mainly in northern Hesse, northern Bavaria, and in Berlin. Seven pairs of these released Peregrines nested in 1984. There were again about 130 occupied Peregrine eyries in West Germany in 1984.

Organochlorines in southern African raptors - a perspective.

JOHN M. MENDELSON (Durban Natural History Museum, P.O. Box 4085, Durban 4000, South Africa), Ashley C. Butler and Ron R. Sibbald (National Institute of Water Research, P.O. Box 17001, Congella 4013, South Africa).

This paper reviews present data on residual levels of chlorinated hydrocarbons in southern African raptors. Unfortunately the data are patchy, and no general patterns are revealed. Similarly, sound evidence of population changes attributable to the effects of these chemicals is lacking. However, some residual levels are high enough to suggest that certain populations suffer the well-known effects of increased mortality and reduced breeding success. Based on the experience of pesticidal effects on raptor populations in the Northern Hemisphere, our data clearly

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 J.W. MOULT (Department of Psychology, University of California,
 Davis, California), D. Peter Giese (1021 Montevideo, 1844 Buenos Aires,
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 and C.H. White (Department of Zoology, Brigham Young University, Provo,
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 South America is presented and is complemented with data from recent
 observations of nesting Peregrine. Currently, information regarding
 false peregrine sightings comes principally from the two southernmost
 countries, Argentina and Chile. Recent field studies showed that "false
 peregrines" is a color phase of *F. g. mexicanus*. Data are also presented
 for a few sites in Peru and as far north as Ecuador. Based on these
 productivity data and sample densities, we tentatively conclude that the
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 extensively distributed geographically than previously estimated.

The conservation of the Peregrine in West Germany.
 TH. MEHN (Sohlwegstrasse 47, D-4500 Essen 1, West Germany).

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 Peregrines which had lived in West Germany in 1950. The surviving popu-
 lation of about 35 pairs each were living in Baden-Württemberg and in
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 1950's, extraordinarily high levels of blood lead were found, especially of
 DDE, DDT and PCB. Since then a decline of the contamination with DDE and
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 increase. The activities have helped to increase the number of nesting
 pairs. In Baden-Württemberg and in Bavaria special groups watch the
 Peregrine during day and night against disturbance by human beings and
 natural predators. As a result of these nesting activities--and probably
 of the lesser contamination with blood lead--the breeding population in
 Baden-Württemberg stood at more than 80 breeding pairs with more than 150
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 (German Falcons' Association) released 191 young captive-produced
 Peregrines, mainly in northern Hesse, northern Bavaria, and in Berlin.
 Seven pairs of these released Peregrines nested in 1984. There were again
 about 150 occupied Peregrine eyries in West Germany in 1984.

Organochlorine in southern African reptiles - a perspective.
 JOHN W. KENNEDY (Durban Natural History Museum, P.O. Box 4082,
 Durban 4000, South Africa), Ashley C. Butler and Ron R. Smit (National
 Institute of Water Research, P.O. Box 11700, Gaborone 4013, South Africa).
 This paper reviews present data on residual levels of chlorinated
 hydrocarbons in southern African reptiles. Unfortunately the data are
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 certain populations suffer the well-known effects of increased mortality
 and reduced breeding success. Based on the experience of pest control
 effects on reptile populations in the Northern Hemisphere, our data clearly

suggest that potential problems exist and that more data are needed to assess their extent in this region. The same, if not more serious, situation exists elsewhere in Africa, and we call for North American expertise to help in investigating the future health of raptor populations in this region.

A review of the status, distribution and ecology of the African Peregrine Falco peregrinus minor.

JOHN M. MENDELSON (Durban Natural History Museum, P.O. Box 4085, Durban 4000, South Africa).

This paper presents a review of the distribution, relative abundance, habitat requirements, feeding and breeding ecology of the African Peregrine Falco peregrinus minor. As noted by other authors, the species is generally rare in Africa and has apparently always been so. Local high concentrations are in areas with very tall cliffs with extensive surrounding forest. Several hypotheses to explain the low density are considered, but none is satisfactory. The heavy use of pesticides in Africa is likely to reduce the small population further.

Overall estimation and changes in the Peregrine population in France from 1945 to 1985.

RENE-JEAN MONNERET (Fonds d'Intervention Pour les Rapaces, Moulin du Haut, 39160 Arlay, France).

Until 1970, the overall situation of the Peregrine Falcon in France is not so well known. Previous numbers have been extrapolated from the numbers recorded in small local populations. Since then, intensive regional studies have been occurring much more often, and they actually cover all the national territory of France. The actual estimate in comparison to the previous studies is more reliable; from 1945 to 1950, the overall population is estimated to have been 900 to 1000 pairs with territories. This very good situation has been followed by a critical period of time from 1955 to 1970. All the regional populations decreased in numbers seriously, and a few of them have been totally eradicated. The number of pairs decreased to 25% to 30% of original number or about 200 to 300 pairs for the whole country. In 1985, the situation is encouraging as the total population in the east of France has been increasing for 10 to 15 years. The actual estimate is 600 pairs. A study of the breeding population in the chain of the Jura Mountains and north of the Alps reveals a certain number of characteristics which give a new point of view in estimating the minimum parameters which have to be considered as necessary to the survival of a population. The numbers of 0.6 young from pairs with a territory, of 1.7 for the breeding pairs, and from .30 to .40 for the ratio of reproductive pairs/pairs with a territory seem to be enough to maintain numbers of the actual population and even increase the population, if it is not subjected to destruction by humans.

Biochemical genetics of Peregrine Falcon populations.

DONALD C. MORIZOT (University of Texas Science Park, Smithville, Texas).

A cosmopolitan sample of some 300 Peregrine Falcon blood samples has been analyzed for genetic polymorphisms at 60 loci by vertical starch gel electrophoresis. Three well resolved polymorphisms exhibit geographic variation in allele frequencies which can be useful in determining population of origin or paternity of individual falcons. Among Peregrine Falcon populations described as subspecifically distinct, no fixed allelic differences have as yet been discovered. One rare allele has been observed at MPI (mannosephosphate isomerase), with frequencies of 0.03 in Colville River, Alaska, birds and 0.02 in birds migrating through Padre Island, Texas. The two-allele polymorphism at LDH1 (lactate dehydrogenase-1) is somewhat more geographically informative: the frequency of the variant allele is highest in Peale's Falcons (0.125), and lower but present in Colville River birds (0.05) and the Padre Island (0.02) and Assateague Island, Virginia (0.04) migrants. The most informative locus is NP (nucleoside phosphorylase) with four identified allozymes (NP 0-3). NP-0 is an uncommon allele in Colville River (0.02) and Colorado (0.05) populations. NP-1 is most frequent in Europe (0.12-1.00), Australia (0.75), and Greenland (0.21). In North American resident populations it has been observed only rarely in Colville River birds (0.02) and at appreciable frequency in migrants (0.08 at Assateague and 0.04 at Padre Island). NP-2 is the common allele in most populations (0.374-1.00) and NP-3 also is common and widespread (0.02-0.50). Electrophoretic mobility variation has been observed in at least seven more proteins and when optimally resolved and genetically interpreted promises to allow elucidation of additional geographic variation in allele frequencies.

Continuing climate changes affect Peregrines and humanity.

MORLAN W. NELSON (The Peregrine Fund, Inc., Boise, Idaho).

Twenty years ago, I made the following observation and prediction: "It is also interesting to know that many of these lakes have increased in surface area since 1961 which was the low point. Precipitation and snow-fall have gone back to previous levels, even to equal those of 1896, and the lakes are gaining in size. They may come back to previous levels within the next 30-70 years." The data used originally are brought up to date, documenting the dramatic rise in the landlocked lakes that are affecting both humanity and Peregrine Falcons. Reasons for this change in the Northern Hemisphere and the World are considered.

Large natural broods increase apparent mortality of parent Peale's Peregrines.

R. WAYNE NELSON (4218 -63 Street, Camrose, Alberta, Canada T4V 2W2).

The additional cost of rearing more nestlings in a brood must be borne by the parents, the progeny, or both. Individually recognizable adult Peregrines at Langara Island, British Columbia, in both 1968-1975 and 1980-1984 disappeared as breeders at a much higher rate in the fall-winter-spring following the production of a brood of 3 or 4 than following the production of a brood of 0, 1, or 2 nestlings. On average, a known Peregrine rearing 3 or 4 nestlings in early-mid-June ($n = 44$ instances)

had only a 57% likelihood of being found as a breeder in the following year; however, a territorial falcon rearing 0, 1, or 2 nestlings in early-mid-June ($n = 60$ instances) was present in the following year in 77% of instances. Preliminary data suggest that usually the members of large broods are not lighter in weight or longer in the nest than the members of small broods. Therefore, the cost of rearing a larger brood is borne almost totally by the adult Peregrines. The implications to clutch-size theory, and to captive and wild management of Peregrines, are discussed.

Population dynamics and regulation in Peregrines.

IAN NEWTON (The Institute of Terrestrial Ecology, Monks Wood Experimental Station, Abbots Ripton, Huntingdon PE17 2LS, England).

The aims of this paper are threefold: (1) to present recent data on the reproduction, survival and dispersal of Peregrines in south Scotland; (2) to discuss the relevance of such data to understanding what determines Peregrine numbers; (3) to discuss how populations might normally be regulated. In south Scotland during 1976-1982, the mean reproductive rate was 1.1 young per territorial pair per year, with considerable annual variation. The mean age of first production was 2.5 years in males (range 2-4) and 2.0 years (range 1-3) in females. (These figures were from small samples and may be biased on the low side.) The annual survival among breeding birds was at least 91% among females, or 89% in both sexes combined. These figures were higher than those obtained from recoveries in national ringing schemes. In their movements between natal and breeding territories, some females moved farther than males, with a median distance for each sex of 83 km and 58 km respectively. Once birds had bred, they tended to nest in the same territories in successive years, though a few males changed territory from one year to the next. These data indicate that past models of Peregrine population dynamics need modification.

Population trends, distribution, and numerical status of the Peregrine in Australia.

PENNY D. OLSEN and Jerry Olsen (CSIRO Division of Wildlife and Rangelands Research, P.O. Box 84, Lyneham, A.C.T. 2602, Australia).

Evidence justifies the retention of only one of the two proposed Australian subspecies of Peregrine, Falco peregrinus marcopus. Numerous and geographically widespread, it occupies all major habitats. For known nest sites, the ratio of cliffs:stick nests:tree hollows is about 6:1:0.8, but varies geographically. Nesting on the ground or on buildings is almost unknown. Breeding distribution is generally patchy and tends to be clumped around areas with ample nest sites and reliable food. Known breeding densities are greatest around permanent fresh waterways, as high as 1 pair/115 sq. km., pairs as close as 1.6 km. Lowest known density is 1 pair/3200 sq. km. in barren Southwest Tasmania. By the early 1970's populations in Victoria and Tasmania may have been reduced to around 80% of historical numbers. In Tasmania eggshell thinning and intensive persecution have decreased, and the population has recovered to an estimated 90%, and is expanding. In Victoria, after a decade of an average decrease in eggshell thickness of over 20%, the population appears to have, in the last two to three years, declined by as much as 10%. The New South Wales study population is stable, limited only by a shortage of nest sites. In parts of

South Australia productivity has declined in recent years; human interference is implicated. Peregrines have not been eliminated from any known major area. Overall, mortality is low (55% in first year, 6% thereafter), and average nest site occupancy, breeding success, and productivity are high (minimums of: 70% of sites occupied, 60% of pairs fledging young, and 1.2 young/pair, respectively). Only major competitors are Black Falcons (Falco subniger) in hunting areas and seacliff-nesting White-breasted Sea Eagles (Haliaeetus leucogaster) for nesting territories. Man's activities have resulted in an increased and more regular food supply. Use of low cliffs (average height in study areas 25-120m), deserted and active quarries and mines, and increased use of stick nests indicate a generally saturated population. Australia has an estimated minimum of 4500 pairs occupying nest sites.

Feather trace element studies with Nearctic Peregrine Falcons: A summary.

JIMMIE R. PARRISH (Dept. Zoology, 159 WIDB, Brigham Young University, Provo, Utah 84602), and F. Prescott Ward (Chief, Environmental Studies Division, Chemical Systems Lab, Aberdeen Proving Ground, Maryland 21010).

In 1978 a study was begun to investigate the trace element content in Peregrine Falcon feathers in North America. The technique of Instrumental Neutron Activation Analysis (INAA) was determined the most expedient method of analyzing feather samples for trace element quantity. Initial results identified 14 trace elements in feathers of nestling Peregrines from the Yukon and Colville Rivers in Alaska, and western Greenland. In addition to determining the most useful method of analysis, initial work was designed to test the disparate nature of feather trace element concentrations from various Nearctic nesting localities. Preliminary results indicated that feather trace element quantities are useful in separating Peregrine breeding localities (Auk 100(3):560-567). Subsequent studies have been designed to test further trace element quantities as a means of determining geographic origins of migrant Peregrines in the Nearctic. An update of this ongoing research is provided. Concentrations of Hg in Peregrine feathers from western Greenland populations represent the lowest Hg levels isolated thus far and thereby provide a basis for comparison with other populations.

Organochlorine contamination in Peregrines and Kestrels and their effects on reproduction.

D.B. PEAKALL (National Wildlife Research Center, Canadian Wildlife Service, Ottawa, Canada), and L.F. Kiff (Western Foundation of Vertebrate Zoology, Los Angeles, California).

The relationship between the residue level of DDE in the egg and the degree of eggshell thinning is examined using field data from the Peregrine (Falco peregrinus) and laboratory and field data on the American Kestrel (Falco sparverius). While good correlations between DDE residue levels and eggshell thickness have been reported for the Peregrine, some other data sets--Canadian data on anatum and tundrius--do not confirm these findings. Combining all data sets available to us a moderate degree of correlation is obtained. For the kestrel a high degree of correlation was found with experimental data and good degree of correlation with field data. Using a large sample of eggs from California (302) examined over

the period 1975-1983 it was found that 16%-20% decrease in eggshell thickness was associated with a marked decrease of reproductive success. The levels of DDE in membrane extracts were measured for 76 samples. Good correlation (0.78) with eggshell thickness was found, and the levels of DDE associated with decreased reproductive success were 300-400 ppm (lipid base, equivalent to 15-20 ppm wet weight). In eastern North America the rather fragmentary evidence available suggests that DDE-induced eggshell thinning was the primary cause of the decline of the Peregrine in the late 1940's early 1950's. The current situation in California also points to this factor as the primary cause of poor reproduction. A similar picture is found in Scandinavia. However, the data from Great Britain indicate that the major declines may have come later (mid-1950's) and were associated with the introduction of the cyclodiene pesticides. Recovery has usually started with inland populations, and in much of Europe populations have returned to pre-DDE levels. However, Peregrine populations are still experiencing difficulties in California and the tropics owing to continued exposure to DDE.

The Peregrine Falcon in the Arabian Gulf and Arabian Peninsula.

JOSEPH B. PLATT (Dubai Wildlife Research Centre, PO Box 11626 Dubai, United Arab Emirates).

Perhaps nowhere in the Peregrine's range is it revered as it is in the Arabian Peninsula. It and the Saker Falcon (Falco cherrug) have been trained by kings and commoners for hundreds of years in the sport of falconry. The training and devotion to the bird have changed little over the generations. About 3,000 falcons are trained each year; perhaps 10% are Peregrines. The majority of all falcons are released to the wild by spring. The traditional pastime of Arabian falconry is now threatened by several factors. Breeding Peregrines in Arabia exist only as F. "pelegrinoides" in southwestern and central Saudi Arabia. The migrant forms appear to be F. p. calidus and F. p. babylonicus. About 35 other species of diurnal raptors occur in the region. During the winter months, Peregrines occur along the Gulf Coast. They feed on waders which are found in huge numbers. Individual falcons appear to maintain winter territories.

Status and reproductive health of marine Peregrines in Baja California and Gulf of California, Mexico.

RICHARD D. PORTER (U.S. Fish & Wildlife Service, Denver Wildlife Research Service, Denver, Colorado), and M. Alan Jenkins (G.M. Sutton Avian Research Center, Bartlesville, Oklahoma).

Included are the data of M.N. Kirven, D.W. Anderson and J.O. Keith and the two authors. These data update the status and productivity of this population from 1975 through 1984. The Peregrine Falcon population was nearly decimated on the Pacific side of the peninsula by 1966. Presently, there are 100 to 102 sites in the area covered by this report where Peregrines have nested at one time or another, 56 of which are on the peninsular coastline of the Gulf or on islands in the Gulf and on islands off the western coast of mainland Mexico. Since 1965, 51 pairs of Peregrines are known to have nested in the Gulf of California. The average rate of occupancy at breeding sites in the midriff area of the Gulf approaches 80%. Four historical sites and two new sites are known to be

occupied on the Pacific side of the peninsula. The mean clutch size for 59 sets of eggs, including eggs plus newly hatched young collected or observed, was 3.27; with elimination of 20 possible incomplete clutches the mean was 3.49 eggs per set. Fledging success of Peregrines in the Gulf is good, but below that of other populations, averaging about two young per pair.

Pollutants in Baja California and Gulf of California Peregrines and prey and reproductive effects.

RICHARD D. PORTER (U.S. Fish & Wildlife Service, Denver Wildlife Research Service, Denver, Colorado), and M. Alan Jenkins (G.M. Sutton Avian Research Center, Bartlesville, Oklahoma).

Muscle tissue from Heermann's Gulls (Larus heermanni) and Black Storm-petrels (Oceanodroma melania) yielded DDE residues exceeding 5 ppm, and 2.07 ppm for Lared Grebes (Podiceps nigricollis). Polychlorinated biphenyl (PCBs, Arochlor 1254) residues in Heermann's Gulls ranged from 1.67 ppm to 1.50 ppm. Lared Grebe, Black Storm-petrel, Least Storm-petrel (Oceanodroma microsoma), and Bonaparte's Gull (Larus philadelphia) tissues yielded 1 ppm or more of mercury. Compared with residues in six species reported by Risebrough et al. (1968) a decade earlier, residues in the same six species among our samples were generally lower. Selenium, arsenic, nickel, and chromium all exceeded 1 ppm in several of the prey species. Risebrough et al. (1968) reported high residues of DDE (98.9 ppm, wet wt.) in a Peregrine egg from the Gulf of California. Two addled eggs collected in 1980, from different Gulf eyries, yielded 11.0 ppm, and 3.1 ppm DDE (wet wt.) and 1.2 ppm and 0.23 ppm mercury. Risebrough et al. reported eggs from a Gulf eyrie with 17% to 34% decrease in shell thickness since 1947. Eggshells collected by us were normal to 38.5% thinner than pre-1947 averages. A molted Peregrine feather contained high levels of mercury (25.8 ppm) and lead (24.6 ppm). A casting containing undigested Peregrine's prey feathers and bones contained 2.43 ppm mercury and 24.9 ppm lead.

Human impacts on environment in relation to past history and biological future of the Peregrine.

DEREK A. RATCLIFFE (Nature Conservancy Council, Northminster House, Peterborough PE1 1UA, England).

Man has had a large direct and deliberate impact on the Peregrine for many centuries, either by using it as an ally in the ancient art of falconry, or treating it as an enemy in competition with himself for a common resource. The one tended to conserve the species, and the other caused its decline in some regions. Indirect impacts of human activities have mostly operated as land-use effects on food supply. Since the Peregrine has adapted to almost all habitats except continuous forest, deforestation has tended to enlarge the area of suitable terrain for it to occupy, up to the point at which desertification may have given the balance of advantage to congeners which replace this species in arid country. Extractive land use in western Scotland has also caused some decline through food supply depletion, and possibly tipped a competitive balance in favour of Golden Eagles. The unforeseen impact of biocides on Peregrines is a unique episode, and should be a passing phase if the lessons can be

applied, in eliminating the use of persistent toxic chemicals around the World and keeping strict surveillance over new compounds which might become further damaging environmental pollutants. The prospects for an early disappearance of persistent organochlorine residues, including PCBs, are not good in the short term. The general story of Peregrine recovery, nevertheless suggests that the worst of this episode is past. The ecological adaptability of the species, so advantageously exploited through captive breeding projects, gives it a fairly bright future--provided that education of people towards a greater respect for birds of prey is maintained as an essential part of the conservation program. Spreading urbanization is not a problem for this species, and increase in direct forms of disturbance seems unlikely to be serious. Only agricultural development so intensive as to cause substantial depletion of food supply, and factors which might decimate populations of domestic pigeons (e.g. epidemic disease) would seem to be serious foreseeable problems. There remains only the final shadow, now extending over Peregrines as over humanity; that a nuclear holocaust could produce a winter of such apocalyptic severity as to destroy all higher life on Earth.

The Madison Conference and research on Peregrines.

DEREK A. RATCLIFFE (Nature Conservancy Council, Northminster House, Peterborough PE1 1UA, England)

The objectives and immediate results of the Madison Peregrine Conference stimulated unprecedented levels of research on this species on both sides of the Atlantic. Extensive communications between the editor of the proceedings, J.J. Hickey, and various researchers around the world quickly led to clarification of the central role which the organochlorine pesticides played in the population declines in both Europe and North America. The sudden decreases in eggshell thickness associated with the onset of extensive post-World War II use of DDT beginning in 1946-1947, first demonstrated for Peregrines, Sparrowhawks, and Golden Eagles in Britain and quickly followed by parallel findings on North American Peregrines and other raptors, provided the major insight needed to understand how sublethal levels of pesticide residues could effect population declines. These results, and others following directly from them, helped to influence decisions to control the use of organochlorine pesticides, and in response Peregrine populations have, happily, begun to recover their numbers in many countries where they had been in decline, aided in part by captive breeding and reintroductions.

The Peregrine population of Britain and Ireland 1965-1985.

DEREK A. RATCLIFFE (Nature Conservancy Council, Northminster House, Peterborough PE1 1UA, England).

The population crash, attributable to organochlorine pesticide contamination, reduced numbers to 44% of pre-war level by 1963 in Great Britain. Restrictions on use of the most harmful chemicals had halted further decline by 1965, and the first signs of recovery appeared in 1967. By 1971, a second countrywide survey showed that breeding population had risen to 54%, with increase in breeding performance. The last national survey, in 1981, showed strong recovery to 90% of pre-1940 level, and subsequent sample surveys suggest that the population is virtually

back to normal in 1985. A parallel decline, possibly equally severe, occurred in Ireland and continued in the Republic until at least 1968. Recovery then set in and has restored numbers completely in Northern Ireland, while in the Republic of Ireland the increase is substantial but not yet complete (ca. 85%). In 1985 at least 800 pairs of Peregrines attempted to breed in Britain, with another 300 in Ireland. In both countries, the cyclodiene group (especially dieldrin) are regarded as the most damaging of the organochlorine insecticides to this species, and population recovery is attributable largely to their gradual withdrawal as seed-dressings. Residual pesticide effects are still identifiable locally, including the egg-breaking and reduced breeding output associated with DDT/DDE, and Peregrine eggshells have shown only partial recovery in thickness. The geographical pattern of recovery in time was at first broadly a reversal of that shown during the decline, but has come to differ in detail. Recovery has remained minimal and breeding performance poor in coastal districts of northern Scotland and its islands, where Peregrines are especially exposed to marine pollutants through the high seabird element in their diet. And no recovery at all is yet reported from the coast of southeast England where pesticide hazards may still be too high. Yet in certain districts, mainly inland, of northern England, southern Scotland and Wales, breeding numbers have risen to a higher level than ever known before, apparently not just from reduction in pesticidal contamination, but from lessening of persecution and increase in food supply.

Peregrine Falcon reintroduction in the Upper Mississippi Valley and Western Great Lakes.

Patrick T. Redig (University of Minnesota, Minneapolis, Minnesota) and HARRISON B. TORDOFF (James Ford Bell Museum, 10 Church St. S.E., Minneapolis, Minnesota).

Experimental Peregrine releases in the Upper Mississippi Valley were made on cliffs along the river in 1976 and 1977, as a part of The Peregrine Fund program. Heavy predation by Great Horned Owls in 1977 terminated the releases. In 1982, new releases were started with Peregrines from other breeding projects. Through 1985, 58 falcons have been released at three sites; Weaver Dunes, along the Mississippi River in southeastern Minnesota (41 birds), Leveaux Mountain on the North Shore of Lake Superior (11 birds), and downtown Minneapolis (6 birds). At Weaver Dunes, we have made multiple releases using two hawk towers about 200 meters apart. Intense owl control for about eight weeks is essential at this site to eliminate loss of falcons. We have not been prevented from using this site by returning territorial falcons from earlier releases because, we think, readily available cliffs along the Mississippi provide much more attractive habitat than the mostly flat dune country. Our city release in 1985 and the two North Shore releases (1984, 1985) suffered no owl predation and all falcons survived to independence. We estimate that about 24 young falcons released each year (our 1985 level) represent about two-thirds of the annual productivity of the pre-DDT Peregrine population in the Upper Mississippi region, thought to number about 30 pairs. It may be possible to phase out releases starting in 1990 as we approach our goal of 15 to 20 established pairs of wild Peregrines. As of 1985, individual Peregrines have been sighted in our region, but no territorial birds or breeding pairs have yet been reported.

Medical treatment of falcons in Arabia.

J. DAVID REMPLE (Dubai Falcon Hospital, P.O. Box 11626, Dubai, United Arab Emirates).

Dubai Falcon Hospital was created in 1983 to provide first of its kind Western medical care for the falcons of the Arabian Gulf. The facility includes surgical, diagnostic laboratory, bacteriological, radiological, respiratory therapy and custodial care capabilities. Traditional concepts of falconry and medical care vary considerably between Middle East and West. Consequently, the frequency of certain disease conditions differs as captive falcons are exposed to conditions and demands far different from the West. Aspergillosis, serratospiculiasis, certain internal parasites, avian pox, and emaciation are among diseases seen in greater frequency in Arabia; a discussion is included. To date the hospital has seen over 450 falcons, and hematological and serological profiles for several disease conditions are being attempted. The hospital in Dubai is creating a central reporting facility and medical records library for the compilation and standardization of clinical case reports on Peregrine Falcons worldwide.

Origins of DDE accumulated by California Peregrine Falcons.

R.W. RISEBROUGH (Bodega Bay Institute, University of California, Bodega Bay, California), W.M. Jarman, J.G. Monk, A.M. Springer, B.J. Walton (The Peregrine Fund, Inc., Santa Cruz, California), and C.G. Thelander (Biosystems, Santa Cruz, California).

Without an active program of nest-site manipulation on the central California coast no or very few young would be produced by the population of Peregrine Falcons, because of very high environmental levels of DDE. Elsewhere in the state reproduction of individual pairs is also impaired by DDE contamination, more than a decade after the ending of DDT use in the state. Origins of the DDE include: 1) the global atmospheric fallout; 2) residual DDE from past use of DDT; 3) migratory prey species which have wintered in Latin America where DDT is still being used; and 4) chloro-DDT, a component of technical Kelthane and other dicofol products. Pesticides containing technical dicofol are extensively used as miticides on the cotton crops in California's Central Valley, introducing an estimated 30,000 pounds of DDE yearly into the valley adjacent to the coast range where the central California population of Peregrine Falcons breeds. The "fingerprint" of residue data from this population supports the hypothesis that pesticides containing technical dicofol have been the source of a significant fraction of the DDE accumulated by this population. Analysis of data from northern California is incomplete at the time of preparation of this abstract, but the "fingerprints" of residue contamination suggest that migrant prey are significant sources of DDE for selected pairs of breeding Peregrine Falcons. The contributions of DDE derived from global fallout and from past use of DDT are assessed. The long-term viability of California Peregrine Falcon populations would appear to depend both on the ending of the uses of technical dicofol containing chloro-DDT and upon a reduction of DDT use in Latin America.

Laws and regulations--their current relevance to Peregrine management.

JAMES L. RUOS (Division of Migratory Bird Management, U.S. Fish and Wildlife Service, Washington, D.C.).

The Peregrine has been "managed" as a species of special interest for more than a thousand years. Depending upon time and place, governments have provided for its protection and authorized its destruction. Early protection was based upon the need to conserve the Peregrine for falconry. Where falconry did not flourish, the Peregrine was considered little more than vermin. There is now ample evidence that these early conservation efforts served more as an expression of social morality than as an effective management program. In spite of harvest by falconers, persecution by game-keepers and egg collectors, the use of this species by man has had little impact on healthy populations. In the mid-20th Century, DDT and other chemicals were recognized as a threat to the Peregrine in parts of Europe and North America. Environmental laws were enacted to encourage its protection and restoration including actions that prohibited the take of Peregrines for falconry. By 1980, these efforts resulted in the significant recovery of Peregrines throughout most of its affected range. As a consequence, falconers were joined by a new and much larger group of conservationists who now share a strong emotional interest in the welfare of the Peregrine but who often differ as to its use in falconry. Incumbent upon governments is the responsibility to support such groups by providing for the interests of all citizens as well as the needs of the resource. Where Peregrine populations are no longer in jeopardy, governments should be responsive to the traditional and legitimate needs of falconers by providing biologically sound and realistic laws for its use in falconry.

Reintroduction of the Peregrine Falcon in Germany.

CHRISTIAN SAAR (Deutscher Falkenorden, Rickhoffweg 25, 2000 Hamburg 70, West Germany).

After the Peregrine Falcon population crash in the 1950's to 1960's in Germany with only a small remaining population surviving in the south, a Peregrine Falcon breeding, releasing, and reintroducing project was started. In 1974 the first Peregrines were produced in captivity. In 1977 the first experimental releases were successful, so that one year later the real releasing program could be started. It has been carried out mainly in Hessen, Bavaria, and West Berlin. Beginning with 7 Peregrines in 1977 we have released falcons every year since in increasing numbers for a total of 245 through 1985. Hacking, fostering, and cross-fostering methods were used. Hacking places were suitable buildings, deserted nesting cliffs, and since 1980, artificial tree nests also (former tree nesting areas). The first breeding success of reintroduced Peregrine Falcons was observed in 1982 in the Harz Mountains in East Germany. Since then at least 13 pairs from our project have taken over nesting sites, at least 9 laid eggs, and at least 34 young have fledged. It is very likely that more pairs exist in the wild, and some birds may have joined the wild population in southern Germany. The most promising fact is the establishment of a Harz breeding population of five pairs west and east of the German frontier. Much interesting information has been collected, and many nice events have happened in connection with the Peregrine reintroducing program.

Behavioral differences in Peregrine Falcon populations.

STEVE K. SHERROD (George Miksch Sutton Avian Research Center, P.O. Box 2007, Bartlesville, Oklahoma).

Populations of Peregrines are found living and hunting prey in a diversity of habitats throughout the world. These populations exhibit both differences and similarities not only in morphology but also in behavior. Greenlandic and Australian Peregrines serve as the primary examples in this paper to illustrate some of these differences and similarities, and speculation is offered on the adaptive significance of characteristics in both categories.

Operation Falcon and the Peregrine.

WILLISTON SHOR (North American Falconers' Association, 318 Montford Ave., Mill Valley, California).

Operation Falcon is one of five sting operations that the Fish and Wildlife Service, Division of Law Enforcement has conducted in the past five years. It is the first to be subjected to substantial scrutiny, and the findings of that scrutiny are disquieting. Government publicity releases contain unsupported and misleading statements concerning numbers of Peregrines taken from the wild and their impact on wild populations. The Service's misleading figures have caused well-meaning people to demand adverse, punitive changes in American laws regulating falconry and captive breeding. Operation Falcon concentrated attention on illegal take in the United States and Canada of live Peregrines for use in falconry, at most a very small threat to limited segments of the Peregrine population, which in any case has been increasing during the past few years. The operation has diverted both attention and resources from threats which potentially have much more biological significance. These include the increasing use of pesticides and illegal take of migrant Peregrines in Latin America, the burgeoning taxidermy trade in parts of Europe, and the pet trade in many countries. Although the Fish and Wildlife Service includes individuals and groups with the capability and function to provide guidance in allocation of resources and attention on the basis of an understanding of the population status and potential threats to the Peregrine, they have not been used effectively. A change in direction to make use of them has the potential of providing substantial help to the Peregrine at no greater cost than the counterproductive effort of Operation Falcon.

Peregrine Falcon recovery plans--concept, implementation, and utility.

JOHN L. SPINKS, JR. (U.S. Fish and Wildlife Service, 1000 North Glebe Road, Suite 500, Arlington, Virginia 22201. Phone 703-235-2771).

Four teams appointed by the Fish and Wildlife Service have developed regional recovery plans for the Peregrine Falcon in Alaska, the Pacific States, the Rocky Mountains/Southwest, and Eastern North America. This paper discusses the efficacy of each plan relative to achieving stated recovery goals and objectives and the manner in which each plan is used by the Service to identify, fund, and carry out recovery tasks. The team approach to recovery plan development, in particular the integration of ideas from Federal, State, and private agencies, has proven successful in achieving agency approval of the plans and support for implementing identified recovery tasks.

Future goals and needs for management and conservation of the Peregrine Falcon.

STANLEY A. TEMPLE (Dept. of Wildlife Ecology, Univ. of Wisconsin, Madison, Wisconsin 53706).

In the United States and Europe reduction in the use of chlorinated hydrocarbons that had caused reproductive failures and intensive management efforts have dramatically improved the status of Peregrine populations in these regions. Specific goals for the recovery of Peregrine populations in the United States have been established by the U.S. Fish and Wildlife Service through its Recovery Teams. I review the present status of U.S. populations with respect to these stated goals and suggest some revisions of the existing goals and management methods in light of recent events. In much of the rest of the world goals for the recovery of depleted Peregrine populations have been less formally stated, so I suggest some goals that seem appropriate under present circumstances. Presently the greatest needs for management and conservation exist in areas where Peregrine populations have not yet begun to recover, in most instances because of the continued existence of chemical pollutants that interfere with reproduction. I conclude with a discussion of some futuristic management activities that might change the status of Peregrine populations even beyond the conventional goals of recovering pre-DDT numbers and distribution patterns.

Prey availability limiting an island population of Peregrine Falcons, Falco peregrinus brookei.

JEAN-MARC THIOLLAY (Dept. of Zoology, E.N.S., 46 rue d'Ulm, 75005 Paris, France).

The decline and low breeding success of a dense population of Peregrine Falcons on an island off Tunisia is attributed to a lack of the most profitable, medium-sized, migratory prey species which have decreased. Most birds are caught over the sea in early morning by the two cooperating adults. Poor hunting success on the more abundant swallows and other small passerines on the island did not allow the breeding Peregrines to feed their young adequately and to cover their energy needs.

Peregrine Falcon (Falco peregrinus anatum), management in the Pacific coast states.

BRIAN J. WALTON (The Peregrine Fund/Predatory Bird Research Group, Lower Quarry, University of California, Santa Cruz, California 95064. Phone: 408-429-2466).

The recovery of the endangered population of Peregrines is being managed through state and Federal wildlife protection laws and regulations, changes in pesticide use, habitat protection efforts, a hands-on management effort (captive incubation of wild eggs and release of captive-reared young), and public education. Three main hands-on techniques have been utilized--fostering, hacking, and cross-fostering. Most young are released by fostering into wild Peregrine nests, fewer have been cross-fostered into wild Prairie Falcon (Falco mexicanus) nests. The most desirable release method is fostering although cross-fostering has been 100% successful. A comparison of the number of young reaching independence by each technique is discussed. Birds released by each technique have

been located as wild breeders. The goal of the management effort is to increase productivity and lower mortality to increase the rate of recovery until this population is stable and nonendangered.

Peregrine Falcon populations in California, Oregon, and Washington: Their Pre-DDT and current status.

BRIAN J. WALTON (The Peregrine Fund, Inc., The Predatory Bird Research Group, University of California, Santa Cruz, California), Carl G. Thelander (The Peregrine Fund, Inc., The Predatory Bird Research Group, University of California, Santa Cruz, California), and David L. Harlow (U.S. Fish and Wildlife Service, Office of Endangered Species, Sacramento, California).

Until the late-1940's, Peregrine Falcon populations in the three Pacific states were estimated to be at breeding densities considered normal for the species. Dramatic declines occurred throughout this region coinciding with exposure to DDT. By 1970, a 95% decline in known active eyries (to less than 5) was reported in California. Similar declines were partially documented in Washington and Oregon, but no detailed studies were conducted. Extensive and detailed surveys in California from 1975 to 1985 indicated a steady increase in eyrie occupancy at previously abandoned locations. Many new eyries were also found, and they may have remained active during the years of decline. From a 1975 low of less than 10 known pairs (all in California), a recovery has occurred to 82 known pairs in 1985 (California, n = 77; Oregon, n = 1; Washington, n = 4). Despite this encouraging recovery, numerous pairs remain unable to hatch their eggs. DDE levels have not lowered, and eggshell-thinning and breakage persist. We believe that continuing exposure to environmental DDE is the primary factor limiting a complete Peregrine recovery in the region. Other possible limiting factors are discussed. A recently discovered new source of DDE, the already high DDE levels in migrant prey species, and existing residues from pre-1972 DDT use have and will continue to inhibit the region's Peregrine recovery effort. Previous estimates of pre-DDT Peregrine populations for the region are considered low. We estimate that the three Pacific states could support a minimum of 300 nesting pairs. Despite radical habitat changes related to urbanization, loss of essential estuarine and wetland habitats, and an increase in human-related mortality factors, recovery to this level is a realistic goal if sources of environmental DDE are eliminated or significantly reduced.

The influence of local weather on autumn migration of Peregrine Falcons on Assateague Island.

F.P. WARD (Chemical Systems, Research Division, Aberdeen Proving Ground, Maryland 21010), W.S. Seegar (Ecology Section, Research Division, DRDAR-CLBTA, Aberdeen Proving Ground, Maryland 21010), M. Yates (address), K. Titus (address), and M. Fuller (Patuxent Wildlife Research Center, Laurel, Maryland 20708).

Weather is known to affect diurnal raptor migration, but the components of weather that influence Peregrine Falcon migration are not well understood. More than 4,400 Peregrine Falcons have been observed from 1970-1984 at Assateague Island, Virginia/Maryland. Over 57% of the observations took place from 2-10 October, but substantial annual variation could have occurred in counts because of weather conditions. Wind direction and

speed, cloud cover, precipitation and barometric pressure influenced the number of sightings and resightings on a given day. Weather conditions associated with greater and lesser numbers of migrants than expected for each date were analyzed using multivariate statistical techniques to discern patterns of migration.

Characteristics of the Migration of Peregrine Falcons at Assateague Island, 1970-1984.

F.P. WARD (Chemical Systems, Research Division, Aberdeen Proving Ground, Maryland 21010), W.S. Seegar (Ecology Section, Research Division, DRDAR-CLBTA, Aberdeen Proving Ground, Maryland 21010), M. Yates (Ecology Section, Aberdeen Proving Ground, Maryland 21010), K. Titus (Ecology Section, Aberdeen Proving Ground, Maryland 21010), and M. Fuller (Patuxent Wildlife Research Center, Laurel, Maryland 20708).

This paper describes the methods used and results obtained from conducting a 15-year study during which migrating Peregrine Falcons (Falco peregrinus) were observed and captured each fall. Of more than 4,400 migrant falcons observed about 88% were young hatched that year and most (ca. 70%) were females. About 25% of all birds observed were captured and banded, and about 12% of those were resighted or recaptured. Peregrines were observed from 29 September to 11 October. There does not appear to be a large difference in dates of migrations by age class. Males and females migrate about the same time. Counts have increased through the 1970's, and by 1979 the number of falcons seen (adjusted for effort) was equal to those seen by observers from 1939-1946.

The Peregrine Falcon in relation to present day falconry.

JAMES D. WEAVER (North American Falconers' Association and The Peregrine Fund, Inc., Laboratory of Ornithology, Cornell University, Ithaca, New York 14850).

The Peregrine Falcon has been the premier bird in falconry in the U.S., and elsewhere, for reasons that are not always obvious or appreciated by those who are not falconers. Current wild population estimates, trends in captive propagation, and falconry statistics indicate that a resurgence in the use of this species is under way and justified. There is every reason to expect that, contrary to the opinions of some, this increased interest will help to ensure the survival of the species for all time and for all people.

Overview of systematics and the subspecies: The interface between genetics, geography, and reality.

CLAYTON M. WHITE (Dept. of Zoology, Brigham Young University, Provo, Utah), and Douglas A. Boyce, Jr.

We address the functional relationship between phenotypes and genotypes in Peregrine populations. We further address the question of whether subspecies designations are useful and, if so, in what context. As a virtually cosmopolitan species with an evolutionary history of at least two million years (Pleistocene) and perhaps as much as five to eight million years (Pliocene) the Peregrine shows considerable variation. With

between 17 and 19 recognized subspecies it really only has two rivals among the Falconiformes for such variation--a kestrel (Falco sparverius) with about 17 and a serpent eagle (Spilornis sp.) with 18 to 27 geographic races, although the species limits of the latter are by no means settled or well defined. The variation within Peregrines reflects both Bergmann's and Gloger's ecogeographic rules, and clines in morphological variation are the general rule among continental populations. Within large areas, local regions that may be poorly represented by specimens may cause an artifact in the nature of the variation and thus confuse our understanding of the subspecies limits (e.g. Australia; South America). An overview of both color and size clines is given with emphasis on problematic areas. There seems to be a lack of concordance between morphological and genetic variation, and while the former may reflect natural selection on phenotypes, it is not clear what the genetic variation reflects. The subspecies designation may be useful to students of evolutionary biology, and has also been used by wildlife managers; but it is often misused and of limited value. Problems relating to misuse are discussed.

Recoveries of Peregrine Falcons migrating through the United States, 1955-1985.

MICHAEL A. YATES (Chemical Systems Lab, Aberdeen Proving Ground, Maryland), Kenton E. Riddle (University of Texas, Bastrop, Texas), and F. Prescott Ward (Chemical Systems Lab, Aberdeen Proving Ground, Maryland).

We analyzed Western Hemisphere bandings and recoveries of Peregrines on file with the Bird Banding Laboratory from January 1955 through June 1985. Greenland records were also examined. Captive-bred Peregrines (and their progeny) and individuals in captivity more than one week were excluded. This study focused on east and gulf coast migrants. The dominant northern population represented in east coast recoveries is that of Greenland, which comprises over half of the banded nestlings recovered there. Alaskan Peregrines dominated Texas gulf coast recoveries. Canadian Arctic populations are associated with a broad-front southerly migration. Very little interchange among banding stations was found between Peregrines banded on the east and gulf coasts. In addition, recoveries of Wisconsin-banded autumn migrants indicate a substantial inland migration passing through the area from Alabama to the southern Atlantic coast; these migrants mostly share wintering areas used by east coast migrants. East and gulf coast migrants share wintering areas in most of Central and South America, but east coast birds have not been recorded wintering between Honduras and United States borders. Gulf coast migrants have not been encountered in the northeast third of South America or in the Cuba/West Indies/Haiti/Antilles corridor. Mortality records on 94 Peregrines banded as hatching-year birds were examined; data indicate that about 64% did not survive through completion of their first spring migration north.

1985 RAPTOR RESEARCH FOUNDATION

SYMPOSIUM ON THE MANAGEMENT OF BIRDS OF PREY

INTERNATIONAL MEETING

Monday, November 4

Workshop: Experimental Design and Data Analysis for Telemetry Projects



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* ABSTRACTS *

SESSION 5

WORKSHOP: EXPERIMENTAL DESIGN AND DATA ANALYSIS FOR TELEMETRY PROJECTS

November 4, 1985
Sacramento, California

Hosted by:

Raptor Research Foundation, Inc.

Held in conjunction with the 1985 Raptor Research Foundation Symposium
on the Management of Birds of Prey, International Meeting

Sponsored by:

Bureau of Land Management
California Department of Fish and Game
California Energy Commission
Hawk Mountain Sanctuary Association
Institute for Wildlife Studies
The National Audubon Society
Pacific Gas and Electric Company
The Peregrine Fund, Inc.
Southern California Edison Company
San Francisco Zoological Society
U.S. Fish and Wildlife Service
The Western Foundation of Vertebrate Zoology

SECTION 3

WORKSHOP: EXPERIMENTAL DESIGN AND DATA ANALYSIS
FOR TOILET PROJECT

November 4, 1987
Palo Alto, California

Hosted by:

Harvard Research Foundation, Inc.

This is a companion to the 1987 Harvard Research Foundation Symposium
on the Management of Waste of Toilets, International Meeting

Sponsored by:

- Division of Land Management
- California Department of Fish and Game
- California State Commission
- Harvard Research Foundation
- Institute for Wildlife Studies
- The National Audubon Society
- Pacific Gas and Electric Company
- The Potomac River
- San Francisco Bay Area Council
- San Francisco Zoological Garden
- U.S. Fish and Wildlife Service
- The Potomac Foundation of Vertebrate Society

Analysis of survival data from telemetry projects.

CHRISTINE M. BUNCK (Patuxent Wildlife Research Center, U. S. Fish and Wildlife Service, Laurel, Maryland 20708. Phone: 301-498-0392), Scott R. Winterstein (Patuxent Wildlife Research Center, U. S. Fish and Wildlife Service, Laurel, Maryland 20708. Phone: 301-498-0443), and Kenneth H. Pollock (Department of Statistics, North Carolina State University, Box 8203, Raleigh, North Carolina 27695. Phone: 919-737-2533).

Telemetry techniques can be used to study the survival rates of animal populations and are particularly suitable for species or settings for which band recovery models are not. Statistical methods for estimating survival rates and parameters of survival distributions from observations of radio-tagged animals will be described. These methods have been applied to medical and engineering studies and to the study of nest success. Estimates and tests based on discrete models, originally introduced by Mayfield, and on continuous models, both parametric and nonparametric, will be described. Generalizations, including staggered entry of subjects into the study and identification of mortality factors will be considered. Additional discussion topics will include sample size considerations, relocation frequency for subjects, and use of covariates.

A review and comparison of techniques for the study of raptor migration.

WILLIAM W. COCHRAN (Illinois Natural History Survey, 607 East Peabody Drive, Champaign, Illinois 61820. Phone 217-352-6849).

A variety of radio telemetry techniques was used in the study of the migratory behavior of Peregrine Falcons (Falco peregrinus), Merlins (Falco columbarius), Sharp-shinned Hawks (Accipiter striatus), and Golden Eagles (Aquila chrysaetos). In addition to migratory routes, data included age, sex, and intra-specific comparisons of rate of travel, flight speed, and altitude; feeding behavior; and weather and topographic influences. Using these and other data sources, data quality, quantity, and cost were compared for banding and radar techniques, and for radio telemetry methods using aircraft, automobile, fixed station, and satellite. As could be expected, the technique of choice was found to depend heavily on research objectives. The penalty for using the wrong method can be failure, an absurd cost, or both.

Applications and considerations for wildlife telemetry.

MARK R. FULLER (U. S. Fish and Wildlife Service, Patuxent Wildlife Research Center, Laurel, Maryland 20708. Phone: 301-498-0282).

Since 1960, biologists have used telemetry to obtain information about a diversity of species and their environments. Information collected includes presence-absence, location, activity, physiological parameters (e.g., temperature), and survival. Telemetry has been used to gather meteorological and micro-climatic data, and to activate and signal closure of capture devices. Transmitters are now available weighing less than a gram, in packages for implantation or use underwater, and with solar cells to provide light weight, long-term power. Receiving systems can be carried by the biologist, mounted on vehicles, or left to operate remotely. Scanning receivers and recording systems can be programmed to monitor numerous frequencies and store data. Engineers continue to provide

biologists with many choices of options and opportunities. The biologist must consider the implications of telemetry including: short- and long-term effects on behavior; cost of equipment and of time devoted to monitoring; sample size and study design; data management (especially storage, editing, manipulation); and analytic methods.

Detecting and describing the structure of an animal's home range.

PAUL H. GEISLER and Mark R. Fuller (U. S. Fish and Wildlife Service, Patuxent Wildlife Research Center, Laurel, Maryland 20708. Phone: 301-498-0313 and 0282).

Biologists can obtain thousands of locations of animals marked with transmitters. Each location includes the animal's coordinates in 4-space (east, north, time of day, day of year). Computer programs were developed to facilitate and standardize the analyses, display, and interpretation of large, complex data sets. Symbolic casement displays of an animal's locations in 5 dimensions (including frequency) and pair-wise (marginal) scatter plots in 3 dimensions (including frequency) allow the user to plot data for visual inspection. A modification of Zahn's locally adaptive clustering procedure, based on a minimum spanning tree, is used to detect internal structure of the home range. When plotted, the clusters of different animals or different times can be compared, allowing the biologist to relate the clusters to habitat, behavior, intensity of use, etc. Computer programs are available from the authors.

Radio telemetry in the study of raptor habitat selection.

W. GRAINGER HUNT (BioSystems Analysis, Inc., 303 Potrero, Suite 29-203, Santa Cruz, California 95060. Phone: 408-425-8755).

Radio telemetry has been an effective tool in investigations of raptor habitat selection because visibility differences between habitats are minimized. My associates and I telemetered about 25 birds in each of three studies. We then conducted frequent surveys by airplane to locate all tagged individuals, or, when necessary, surveyed the entire study area. We then constructed habitat and prey distribution maps and overlaid the locations of telemetered birds. Simple statistical tests, such as Chi-Square and Spearman Rank correlations, were useful in evaluating the relative distributions of raptors, habitat, and prey. A study of habitat use during spring staging of Peregrines in southern Texas showed that tidal flats and dune-lake areas on Padre Island were favored non-randomly over other habitats. Wintering Bald Eagles telemetered in Washington and California moved seasonally within broad geographical areas in response to changes in prey availability. Distributions of Bald Eagles along river courses and reservoirs corresponded to habitat and food distributions. Nesting pairs of telemetered Bald Eagles selected river pools over runs, riffles, and pocket water and avoided areas where prey species compositions, biomass, and/or prey-size categories were adversely affected by water quality. Telemetry was also useful in alerting observers in blinds on river pools to impending foraging attempts.

Biologists with many studies of wildlife and agriculture. The biologist must consider the relationship of wildlife to agriculture, forest and land-use patterns in general, and of the impact of land use on wildlife. Wildlife management, especially hunting, fishing, and trapping, and wildlife conservation, are also important.

Research and development of wildlife and agriculture. The biologist must consider the relationship of wildlife to agriculture, forest and land-use patterns in general, and of the impact of land use on wildlife. Wildlife management, especially hunting, fishing, and trapping, and wildlife conservation, are also important.

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Telemetry in studies of predation, dispersal, and demography.

ROBERT KENWARD (Institute of Terrestrial Ecology, Furzebrook Research Station, Wareham BH20 5AS, England. Phone: 09295/2992).

Goshawk data from Britain and Sweden show how radio tags can be used to investigate the population dynamics, predatory behavior, survival, and movements of raptors following artificial release or natural fledging. By using radio surveillance and posture-sensing tags, data on the hunting behavior and winter diet of Goshawks can be collected with minimal bias. In seven areas with a good road net and high hawk density, rates of killing pheasants were estimated by monitoring 3-6 hawks at a time. The radio tags were also used to estimate hawk density and hence the total predation rates, and to determine which types of traps selected pheasant-killing hawks. In another study, Goshawks trained for falconry were released with radio tags to record their survival and thus help to assess falconry's role in re-establishing a British Goshawk population. The post-fledging dispersal, mortality, and proportion breeding have been recorded recently for about 200 juvenile hawks and 100 adults on Gotland (a Baltic island), using leg-tags on nestlings and highly reliable 10-month tail-mounts on fledged hawks.

Basic techniques for analyzing movement and home-range data.

VICKY J. MERETSKY (Condor Research Center, 2291A Portola Rd., Ventura, California 93003. Phone: 805-644-1766).

Simple graphic techniques suffice to demonstrate movements observed while tracking migrating animals, but do not permit hypothesis testing. Circular statistics permit summary and hypothesis testing of movement data. The basic approach of circular statistics and the existence of parametric and non-parametric tests will be discussed. Radio telemetry observations most often result in a series of point observations of animal movements. Many published analytical techniques provide different kinds of home-range assessment using these point observations and make different requirements of and assumptions concerning the data. Representative analyses and their needs and results will be discussed.

Experimental design of radio telemetry projects.

KENNETH H. POLLOCK (Department of Statistics, Box 8203, North Carolina State University, Raleigh, North Carolina 27695-8203. Phone: 919-737-2531).

Radio telemetry projects have many different goals and, in fact, even within one project there may be multiple objectives. This makes achievement of sound experimental design especially difficult. In this talk I briefly discuss experimental design for several different types of studies. Trade off between following large numbers of individuals for short intermittent periods of time versus following a small number of individuals very intensively will be considered. Some examples from the literature will be used for illustration.

Voluntary in studies of predation, dispersal, and demography.
 HUBERT REWARD (Institute of Terrestrial Ecology, Edinburgh Research
 Station, Victoria Road, Edinburgh, EH6 6AA, Scotland. Phone: 0273/22222)
 Current data from Britain and Sweden show how radio tags can be used to
 investigate the population dynamics, predatory behavior, survival, and
 movement of raptorial following artificial release or natural fledging. By
 using radio surveillance and position-locating tags, data on the hunting
 behavior and winter diet of Goshawks can be collected with minimal risk.
 In seven areas with a good road network and high hawk density, rates of killing
 pheasants were estimated by monitoring 1-3 hawks at a time. The radio
 tags were also used to estimate hawk density and hence the total predation
 rates, and to determine which types of farms selected pheasant-killing
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 radio tags to record their survival and then help to assess Voluntary's
 role in re-establishing a British Goshawk population. The great-fledging
 dispersal, mortality, and proportion hawking have been recorded recently
 for about 100 juvenile Goshawks and 100 adults in Scotland (a British island),
 using tag-sets on nestlings and night calls in 10-month follow-up on
 fledged hawks.

Radio techniques for analyzing movement and home-range data.
 VIKKI J. WENDELL (Concord Research Center, 333A Victoria Rd., Victoria,
 British Columbia V8N 2Z2, Canada. Phone: 252-0441-1500)
 Radio-telemetry techniques continue to demonstrate movement of animals
 and tracking dispersing animals, but do not permit hypothesis testing.
 Classical statistical power analysis and hypothesis testing of movement
 data. The basic approach of circular statistics and the existence of
 periodicity and non-periodicity tests will be discussed. Radio-telemetry
 observations most often result in a series of points (observations of animal
 movements). Many published analytical techniques provide different kinds
 of data-range assessment using these point observations and some different
 representations of and assumptions concerning the data. Representative
 analysis and their results and results will be discussed.

Experimental design of radio-telemetry projects.
 JOHN E. FOLLOCK (Department of Statistics, Box 2603, North Carolina
 State University, Raleigh, North Carolina 27695-2603. Phone: 919-737-2221)
 Radio-telemetry projects have many different goals and, in fact, even
 within one project there may be multiple objectives. This makes achieving
 good or sound experimental design especially difficult. In this talk I
 briefly discuss experimental design for several different types of studies.
 Trade-offs between following large numbers of individuals for short inter-
 mittent periods of time versus following a small number of individuals
 very intensively will be considered. Some examples from the literature
 will be used for illustration.

1985 RAPTOR RESEARCH FOUNDATION

SYMPOSIUM ON THE MANAGEMENT OF BIRDS OF PREY

INTERNATIONAL MEETING

Wednesday, November 6
Workshop: Effective Public Relations & Public Education
for Raptor Conservation



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* ABSTRACTS *

SESSION 6.

WORKSHOP: EFFECTIVE PUBLIC RELATIONS AND PUBLIC EDUCATION FOR RAPTOR CONSERVATION

November 6, 1985
Sacramento, California

Hosted by:

The San Francisco Zoological Society

Held in conjunction with the 1985 Raptor Research Foundation Symposium
on the Management of Birds of Prey, International Meeting

Sponsored by:

Bureau of Land Management
California Department of Fish and Game
California Energy Commission
Hawk Mountain Sanctuary Association
Institute for Wildlife Studies
The National Audubon Society
Pacific Gas and Electric Company
The Peregrine Fund, Inc.
Southern California Edison Company
San Francisco Zoological Society
U.S. Fish and Wildlife Service
The Western Foundation of Vertebrate Zoology

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Raptor education at the San Francisco Zoo.

JOHN R. AIKIN (Conservation Center, San Francisco Zoological Society, Zoo Road, San Francisco, California 94132. Phone: 415-566-0481).

In 1982 the San Francisco Zoological Society developed a raptor education program to draw public interest in raptor biology and conservation. The scope of the program extends beyond the one million annual zoo visitors to provide in-depth information on raptor biology and conservation to community members. Two key features highlight this innovative program. The first feature is the Bird of Prey Conservation Education Series. The goals of the Education Series are: 1) to teach volunteers to train and care for the zoo's collection of raptors, 2) to give volunteers a firm background in raptor biology, ecology, and conservation (including rehabilitation), 3) to train the volunteers for involvement in raptor research at the zoo, and 4) to provide the above services for other community members, including wildlife professionals from wildlife rehabilitation centers, zoos, and junior museums. For the zoogoers, a spectacular flight and feeding demonstration accompanies a twenty-minute talk on raptor biology and conservation. This unique program is facilitated by forty specially trained volunteers, and it features raptors that were injured in the wild and cannot be released.

Public relations: projecting a positive image for wildlife programs.

JOHN BORNEMAN (National Audubon Society, 2291-A Portola Road, Ventura, California 93003. Phone: 805-658-6422).

This paper will deal with methods for dealing with media and the general public.

Schoolyard hawk watch.

JAMES J. BRETT (Hawk Mountain Sanctuary Association, Route 2, Kempton, Pennsylvania 19529. Phone: 215-756-6961).

Edwina Tchaikovsky of the Concord School District in Concord, New Hampshire, has been working on Schoolyard Hawk Watch for the past decade and has done remarkable things with her 5th grade students. With the assistance of faculty members and parents, the students have written and choreographed a splendid program on hawk watching. All of the words and musical scores are original, and the group has performed throughout the northeast, including the Raptor Research Foundation meeting in Montreal in 1981 and Hawk Mountain Sanctuary's 50th anniversary celebration in 1984. The Concord school kids watch hawks from their schoolyard or roof tops, but before doing so each year get acclimated to identification, flight pattern, and migration dynamics through song, dance, and pantomime. Highlights of the group's program are featured in this 20-minute video.

Multimedia and enthusiasm: effective tools in raptor education.

RICHARD D. BROWN (Carolina Raptor Center, Inc., P.O. Box 16443, Charlotte, North Carolina 28297-6443. Phone: 704-875-6521 or in the United States 1-800-CALL-OWL).

Education of the public is the key to the survival of raptors. There are a variety of methods available to the educator to get the raptor message across to the public. Each method has its limitations depending on the time available, location, and the audience. Since the public is so "entertainment" oriented, due to the ease of the availability of television in the home, one must, to be most effective, choose the right method for the right occasion. Developing an "entertainer's attitude" is perhaps the most important tool available to the educator. The Carolina Raptor Center has given over 1,350 programs to over 300,000 people. Our most effective results have come from the use of multimedia. Dissolving equipment, sharp images on a large screen, with music and live, nonreleasable habituated birds of prey make an excellent program. For good photographs, remember: "Fill the frame is the name of the game," and "what you see is what you get." While the use of slides is old, an upgrading of their use with a mixture of enthusiasm and good photography will guarantee maximum effectiveness in raptor education.

Traveling talons.

WALTER C. CRAWFORD (Raptor Rehabilitation and Propagation Project, Inc., Tyson Research Center, Box 193, Eureka, Missouri 63025. Phone: 314-938-6193).

Perceiving natural symbols is a part of man's nature and is essential to his mental health. The increasing interest in birds of prey and our environment by the general public has resulted in a tremendous demand for educational presentations and programs in these areas. Because of these demands, the Raptor Rehabilitation and Propagation Project, Inc., initiated an Environmental Awareness Education Program (EAEP) to help fill this void in education. Our program consists of a coherent presentation involving live specimens of both common and rare forms of birds, primarily birds of prey such as hawks, vultures, owls, eagles, and falcons. These are not only brought out to the audience to show particular characteristics of each bird, but are used to demonstrate particular behaviors, such as soundless flight of owls, the use of ground lift in hawk flight, mid-air acrobatics of falcons, etc. Most people are awe struck with the dynamic beauty of such birds in flight because not often does the average person experience the thrill of having seen a live hawk or falcon fly within a few feet. It is essential when using live specimens that 1) all birds be in excellent feather condition, 2) jesses and all equipment, such as perches, carrying cases, etc., be properly used and, most importantly, 3) professionalism be stressed. Our transportation vehicle, a converted bus, provides excellent traveling conditions for all birds and staff. "Traveling Talons," our EAEP bird of prey program, has been on the road 8-1/2 months in 1985 providing education about birds of prey to concerned audiences.

Michigan and Wisconsin: effective tools in rapid education.
RICHARD G. HUNTER (Lansing) began, Jan. 9, 1962, for 1962,
Chicago, North Carolina State Dept. of Education, 100-100-1001 or in the
United States 1-800-221-0011.

Education of the public is the key to the survival of democracy. There
are a variety of methods available to the educator to get the right
message across to the public. Each method has its limitations depending
on the time available, location, and the audience. Since the public is so
"entertainment" oriented, due to the mass of the availability of television
in the home, one must, in the most effective manner, use the right method for
the right occasion. Developing an "entertainment" attitude is perhaps the
most important tool available to the educator. The United States Dept. of
Education has given over 1,100 programs to over 100,000 people. Our most effective
results have come from the use of television. Developing programs, using
images on a large screen, with music and live, nonverbalistic techniques
blends of play with an excellent program. For good photographs, illustrations,
"Will the Train be the name of the game," and "What you see is what you
get." While the use of slides is old, an upgrading of their use with a
mixture of animation and good photography will guarantee maximum
effectiveness in rapid education.

Traveling Sales
RICHARD G. HUNTER (Lansing) began, Jan. 9, 1962, for 1962,
Chicago, North Carolina State Dept. of Education, 100-100-1001 or in the
United States 1-800-221-0011.

Traveling sales is a part of man's nature and is essential
to his mental health. The increasing interest in this type of play and
entertainment by the general public has resulted in a tremendous demand for
educational presentations and programs in these areas. Because of these
demands, the National Education Association and the National Council of
Educational Measurement (NCEM) have joined to help this type of
in education. The program consists of a constant presentation involving
live specimens of birds, mammals and rare forms of plants, primarily birds of
prey such as hawks, eagles, owls, falcons, and vultures. These are not
only brought out to the audience to show particular characteristics of
each bird, but are used to demonstrate particular behaviors, such as
moult, flight, etc. The use of ground lifts to show flight, and air
moult, etc. Most people are not aware of the importance of the
behavior of each bird in flight because it often shows the average person
regarding the skill of flying seen a few miles or less away. It is with a
live bird. It is essential when using live specimens that all birds be
in excellent feather condition. It is also essential that all specimens, such as
bones, be properly cared for and not damaged. The transportation vehicle, a converted
1955 Chevrolet, is equipped with a generator for all birds and staff.
The "Traveling Sales" was first kind of play program has been on the road
3-1/2 months in 1962 providing educational value birds of prey to thousands
of people.

Raptor banding demonstrations as an educational vehicle.

PETE DUNNE and William S. Clark (New Jersey Audubon Society, Cape May Bird Observatory, P.O. Box 3, Cape May Point, New Jersey 08212. Phone: 609-884-2736).

At Cape May, New Jersey, as part of the fall raptor project, hawk banding demonstrations have been used to convey an education and conservation message to residents and visitors--and as a means of gaining financial support for the project. Between one and five newly captured and banded birds of several common migratory raptor species are carried to a central location. Birds are held by the bander as he or she points out key plumage points or morphological adaptations and discusses such related subjects as: identification, range, habitat, diet, hunting techniques, migration, and the importance of habitat. Following these discussions, birds are released. Benefits include the assured attention of the audience. Problems include: potential for injury to birds, fielding delicate questions, and engendering an interest in raptor ownership among individuals who lack skills in raptor care.

Getting a raptor education program to take flight.

ANN GALVIN HOMAN (Raptor Support Team, Santa Barbara Zoological Gardens. Home address: 1701 Country Lane, West Trenton, New Jersey 08628). Additional slides by Richard L. Homan (same address) and Nancy Hollenbeck (Santa Barbara Zoological Gardens, 500 Ninos Dr., Santa Barbara, California 93101. Phone: 805-966-2863).

The fledgling raptor education program at the Santa Barbara Zoo has been an adventure. We use only unreleasable raptors in demonstrations designed to educate zoo visitors about the ecological importance of raptors and to publicize the efforts of wildlife rehabilitation programs. As the chairperson for the all-volunteer support team, I reached out to local falconers, rehabilitation centers, and California Fish and Game Department personnel. I adapted sometimes conflicting expert advice to care for and handle injured raptors in the atmosphere of a small zoo. Problems at our zoo have included communication difficulties between paid staff and volunteers, limited budget for housing, disagreements on falconry techniques, squeemishness of volunteers to feed raptors live food, volunteer attrition, and reconciling public educational demonstrations for an entertainment-seeking audience with our zoo's conservation goals.

Videotape as a means of communicating concepts in raptor conservation.

J. MARK JENKINS (Department of Engineering Research, Pacific Gas and Electric Company, 3400 Crow Canyon Road, San Ramon, California 94583. Phone: 415-820-2000).

Videotape provides an effective new medium for communicating results of raptor-related research and management projects to general audiences. The growing availability of videotape recorders (VCR's) in home and office allow for distribution and viewing of "videos" much the same as with reports or brochures. A 10-minute videotape was produced on a Bald Eagle and fish study at Pacific Gas and Electric Company's Pit River hydroelectric project in Shasta County, California. The videotape has been well received by a wide variety of audiences. This presentation includes a showing of the videotape.

High School Hawk Watch Program.

DEBBIE KELLER and Pete Dunne (New Jersey Audubon Society, Cape May Bird Observatory, P.O. Box 3, Cape May Point, New Jersey 08212. Phone: 609-887-0045 and 201-571-1887).

Secondary schools are in need of field research projects that challenge and broaden student awareness, are low cost, and may be conducted on school grounds. The High School Hawk Watch Program developed through a grant from the Geraldine R. Dodge Foundation and support from the Hawk Migration Association of North America, meets these criteria. Raptor migration is a readily observable natural phenomenon which occurs for approximately two months in the spring and two months in the fall. Both periods fall within the school calendar year. Students are instructed in raptor identification, field techniques, data gathering, and data analysis. Paper development and presentation are encouraged by supervision by a Project Coordinator, a Hawk Watch Manual, and a student conference. First implemented in 1983, over 30 schools have participated in the program to date.

Raptors and man: a Native American art exhibit.

RONALD D. LAMB (Southern Oregon State College, Ashland, Oregon 97520. Phone: 503-482-4346) and Ralph Wehinger (Pacific Northwest Raptor Rehabilitation Corporation, Eagle Point, Oregon 9752. Phone: 503-826-6800).

In order to develop a greater awareness, understanding, and appreciation for the role that raptors have played in Native American cultures, as well as to emphasize the continuing ecological importance of raptors to man and the ecosystem, the Pacific Northwest Raptor Rehabilitation Corporation (PNRRC) in cooperation with Southern Oregon State College (SOSC) and the Institute of American Indian Arts (IAIA) is developing an art exhibit incorporating materials from raptors. Native Americans from the IAIA will create authentic forms, both traditional and new, that will form the nucleus of the exhibit. Educational modules and a catalog of the art exhibit are being developed by faculty and students at SOSC and the IAIA. Textual material will be edited by Alvin Josephy. Also, under development is an impact assessment device to be administered before and after the contributions from participants in excess of \$130,000. Contributions in the form of cash amounts to \$23,000 and grants amounting to \$152,000 are currently being pursued.

The International Year of the Raptor: a major instrument in promoting education on raptor conservation in the world.

YOSSI LESHEM (Israel Raptor Information Center, Society for the Protection of Nature in Israel, Har Gilo, D.N. Harei Jerusalem, Israel. Phone: 02-741661).

The International Council for Bird Preservation (ICBP) World Working Group on Birds of Prey has declared 1987 International Year of the Raptor. The World Working Group, the Israel Raptor Information Center, and Hawk Mountain Sanctuary are organizing the conference of the World Working Group in Israel in March 1987. The purpose of this campaign is to involve as many national and international nature conservation organizations as possible in a concentrated effort to increase awareness of conservation problems of birds of prey. One step in this direction is the preparation

of an international educational kit which will include 16mm films, video cassettes, booklets, and pamphlets. The kit will come in various languages for worldwide distribution. The films will be prepared from existing material which will be donated for the purpose of this project. The publications of each national organization (calendars, posters, greeting cards, etc.) will be devoted to birds of prey during this year. After the conference in Israel there will be an international festival which will include photographic, film, and art competitions on the subject of raptors. Any profits from the campaign will be dedicated to raptor conservation projects which will be decided upon by a special committee.

The Israel Raptor Information Center (IRIC): an important educational tool in the raptor conservation field.

YOSSI LESHEM (Israel Raptor Information Center, Society for the Preservation of Nature in Israel, Har Gilo, D.N. Harei Jerusalem 91076 Israel. Phone: 02-741661).

The IRIC was established five years ago as a joint project of the Society for the Protection of Nature in Israel (SPNI) and Tel-Aviv University. Five years of intensive work have borne fruit. Public awareness of conservation problems facing birds of prey in Israel has grown significantly. The subject has been introduced to many and varied sectors of the public in a variety of ways. The IRIC is active on five main levels:

- a. With the general public--intensive work with the mass media (hundreds per year), free excursions on raptor-related subjects and programs which actively involve interested members of the public, such as raptor migration surveys or projects to guard nesting birds of prey.
- b. Within the school system--preparation of educational material for students and teachers, audio-visual material, study days for teachers, and help and encouragement for students working on raptor-related subjects.
- c. With SPNI members--the SPNI has 40,000 members (adults and youth) with special interest in nature and its conservation. Special courses are organized for them, and the Torgos and other more specific booklets on birds of prey are published.
- d. With staff of the SPNI, Israel Nature Reserves Authority, and university students--special advanced courses are given which provide background for participation in research projects and surveys.
- e. Establishing a core for supporters--about 6,000 people are directly connected at present to the IRIC and active as volunteers at all levels.

All this is most impressive in a country such as Israel, where 70% of the population originated over the past 30-40 years from areas with no history of education or activity in nature.

A whale of a tale: how to get your story into the media.

ELLEN NEWMAN (San Francisco Zoological Society, Zoo Rd., San Francisco, California 94132. Phone: 415-661-2923).

The media loves animal stories, done their way. The trick is to tell your story so that the media finds it irresistible. This session will review some successful examples and then present some tips on how to get your story to the public.

Obtaining funding for the Raptor Conservation Program at the San Francisco Zoo: a sampling of case histories.

NANCY RATZESBERGER (San Francisco Zoological Society, Zoo Rd., San Francisco, California 94132. Phone: 415-661-7456).

This paper describes the processes utilized in obtaining funding for the San Francisco Zoological Society's Raptor Conservation Program. During the 1985 fiscal year, we procured four grants for conservation projects. The State of California, through its Environmental License Plate Program, awarded the zoo \$175,000 to design and plan the Bird of Prey Conservation and Research Center. The Institute of Museum Services, a Federal granting agency, gave us a matching grant of \$25,000 to expand our captive propagation research program to include field work involving California raptors. We worked with the Golden Gate National Park Association to procure funding for a raptor banding station in Marin County to collect data critical for the management of wild raptor populations. The strategy used to obtain these funds will be delineated.

The Peregrines (Falco peregrinus anatum) of Marin.

SCOTT A. STENDER (775 Cole No. 1, San Francisco, California 94117. Phone: 415-752-0965).

A nine-minute video documentary on the hacking of three female Peregrine Falcons at a site near Muir Beach, Marin County, California, during the summer of 1985. Interviews with the hack site attendant and minimal narration are combined with action footage of Peregrines being banded and spectacular flying shots.

Strategic planning for fund development.

MARILYN C. TRIBBEY (3138 Clairidge Way, Sacramento, California 95821. Phone: 916-482-6003).

The shaping of a strategic plan prior to any fund raising activity is the single most important aspect of the fund development function. In this process, volunteers and staff managers join to examine the mission of the organization as it relates to the goals and objectives which will accomplish that mission. The clarification of issues involved in this evaluation provides the framework for the case statement, the written document which serves as a resource for questions asked by potential donors. Guidelines for developing case statements are the focus of this presentation.

Raptor awareness program of the Missouri Department of Conservation.

JAMES D. WILSON (Missouri Department of Conservation, P.O. Box 180, Jefferson City, Missouri 65102).

Missouri Department of Conservation raptor awareness programs are designed to promote habitat on privately owned lands, to inform the public of laws, and to stimulate or enhance an appreciation of individual species and their ecological role. Public interpretive events, such as Eagle Days and Prairie Days, have been highly successful in promoting this awareness. Since their inception in 1978, Eagle Days has been attended by as many as 3,000 people per weekend. Characteristics of attendees will be discussed. Examples of Missouri Department of Conservation's raptor literature will also be presented.

Report number program of the Missouri Department of Conservation
JAMES D. WILSON, Missouri Department of Conservation, P.O. Box 160,
Jefferson City, Missouri 64102
Missouri Department of Conservation report number program are
designed to provide habitat or privately owned lands, to inform the pub-
lic of laws, and to stimulate or enhance an appreciation of individual
species and their ecological role. Public interpretive events, such as
Eagle Days and Wildlife Days, have been highly successful in promoting this
awareness. Eagle Days began in 1976, Wildlife Days have been attended by
as many as 2,000 people per weekend. Characteristics of attendance will be
discussed. Examples of Missouri Department of Conservation's report
literature will also be presented.

1985 RAPTOR RESEARCH FOUNDATION

SYMPOSIUM ON THE MANAGEMENT OF BIRDS OF PREY

INTERNATIONAL MEETING

Thursday, November 7 and Friday, November 8
Western Hemisphere Meeting of the
World Working Group on Birds of Prey



* PROGRAM *

SESSION 7

THURSDAY, NOVEMBER 7, 1985--CALIFORNIA ROOM

WESTERN HEMISPHERE MEETING OF THE
WORLD WORKING GROUP ON BIRDS OF PREY

I. WELCOME AND OPENING

Chairman: A.D. Chancellor, International Council for Bird Preservation
(British Society for the Study of Biology, 23 Queensberry
Place, London)November 7-8, 1985
Sacramento, California

Hosted by:

The Western Foundation of Vertebrate Zoology
and
Raptor Research Foundation, Inc.Held in conjunction with the 1985 Raptor Research Foundation Symposium
on the Management of Birds of Prey, International Meeting

Sponsored by:

Bureau of Land Management
California Department of Fish and Game
California Energy Commission
Hawk Mountain Sanctuary Association
Institute for Wildlife Studies
The National Audubon Society
Pacific Gas and Electric Company
The Peregrine Fund, Inc.
Southern California Edison Company
San Francisco Zoological Society
U.S. Fish and Wildlife Service
The Western Foundation of Vertebrate Zoology

* NOTICE *

* It is intended that the papers presented during this session be *
* published as the Proceedings of the Western Hemisphere Meeting *
* of the World Working Group on Birds of Prey. All authors are *
* accordingly requested to hand copies of their papers to the *
* WWG Secretary, Robin D. Chancellor, at the end of each session. *
* Alternately, copies should be sent without delay to R.D. *
* Chancellor, 15 Bolton Gardens, London SW5 0AL England. *

THURSDAY, NOVEMBER 7, 1985--CALIFORNIA ROOM

I. WELCOME AND COUNTRY REPORTS

Chairman: R.D. Chancellor, International Council for Bird Preservation
(British Section), c/o Institute of Biology, 20 Queensberry
Place, London 2W7 2DZ, England

7-1	8:00 a.m. JOSEPH R. MURPHY	Welcome on behalf of the World Working Group on Birds of Prey
7-2	8:05 a.m. JEFFREY L. LINCER	Welcome on behalf of Raptor Research Foundation
7-3	8:10 a.m. BERND-ULRICH MEYBURG	Opening Remarks
7-4	8:20 a.m. FABIAN M. JAKSIC	<u>Chile</u>
7-5	8:35 a.m. JORGE ALBUQUERQUE	<u>Brazil</u>
7-6	8:50 a.m. FERNANDO ORTIZ-CRESPO	<u>Ecuador</u>
7-7	9:05 a.m. MICHAEL P. WALLACE	<u>Peru</u>
7-8	9:20 a.m. RICHARD W. FYFE	<u>Surinam</u>
7-9	9:35 a.m. JEAN-MARC THIOLLAY	<u>French Guiana</u>
7-10	9:45 a.m. DAVID H. ELLIS	<u>South America At Large</u>
	10:00 a.m. BREAK	

Chairman: Bernd-Ulrich Meyburg, World Working Group on Birds of Prey,
Herbert-Str. 14, D-1000 Berlin 33, Federal Republic of Germany

7-11	10:15 a.m. NATHAN GALE	<u>Panama</u>
7-12	10:30 a.m. JUAN CARLOS MARTINEZ-SANCHEZ	<u>Nicaragua</u>
7-13	10:45 a.m. JORGE A. IBARRA	<u>Guatemala</u>
7-14	11:00 a.m. JACK CLINTON-EITNIEAR	<u>Belize</u>

NOTICE

It is intended that the papers presented during this session be
 submitted as the Proceedings of the Western Hemispheric Meeting
 at the World Meeting Group on Birds of Prey. All authors are
 requested to send copies of their papers to the
 Hon. Secretary, Robin D. Charnell, at the end of each session.
 Alternatively, copies should be sent without delay to R.D.
 Charnell, 15 Nelson Gardens, London NW5 2LL, England.

PROCEEDINGS, SEPTEMBER 7, 1982--CALIFORNIA ROOM

1. WELCOME AND COFFEE SERVICE

Chairman: R.D. Charnell, International Council for Bird Preservation
 (British Section), c/o Institute of Biology, 20 Queen Mary
 Street, London NW5 2LL, England

9:00 a.m. WELCOME & COFFEE SERVICE	9:00 a.m. WELCOME & COFFEE SERVICE
9:15 a.m. WELCOME & COFFEE SERVICE	9:15 a.m. WELCOME & COFFEE SERVICE
9:30 a.m. WELCOME & COFFEE SERVICE	9:30 a.m. WELCOME & COFFEE SERVICE
9:45 a.m. WELCOME & COFFEE SERVICE	9:45 a.m. WELCOME & COFFEE SERVICE
10:00 a.m. WELCOME & COFFEE SERVICE	10:00 a.m. WELCOME & COFFEE SERVICE
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11:45 a.m. WELCOME & COFFEE SERVICE	11:45 a.m. WELCOME & COFFEE SERVICE
12:00 a.m. WELCOME & COFFEE SERVICE	12:00 a.m. WELCOME & COFFEE SERVICE

12:00 a.m. BREAK

Chairman: Robin D. Charnell, International Council for Bird Preservation
 (British Section), c/o Institute of Biology, 20 Queen Mary
 Street, London NW5 2LL, England

10:00 a.m. WELCOME & COFFEE SERVICE	10:00 a.m. WELCOME & COFFEE SERVICE
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11:45 a.m. WELCOME & COFFEE SERVICE	11:45 a.m. WELCOME & COFFEE SERVICE
12:00 a.m. WELCOME & COFFEE SERVICE	12:00 a.m. WELCOME & COFFEE SERVICE

7-15	11:10 a.m.	MARIO A. RAMOS	<u>Mexico</u>
7-16	11:25 a.m.	JAMES WILEY	<u>West Indies</u>
7-17	11:40 a.m.	CLAYTON M. WHITE	Summary of country reports
	12:00 noon	LUNCH BREAK	

II. SPECIAL REPORT

7-18	1:00 p.m.	BERND-ULRICH MEYBURG	Threatened and near-threatened birds of prey species of the World
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III. ESTABLISHMENT OF PRESERVES FOR RAPTORS

7-19	2:00 p.m.	JAMES A. MOSHER	Discussion
	2:45 p.m.	BREAK	

IV. SYMPOSIUM ON LEGISLATION AND REGULATIONS

Chairpersons: Peter J. Robinson, Royal Society for the Protection of Birds, The Lodge, Sandy, Bedfordshire SG19 2DL, England and
Margaret E. Cooper, c/o John E. Cooper, Royal College of Surgeons of England, London WC2A 3PN, England

7-20	3:00 p.m.	PETER J. ROBINSON MARGARET E. COOPER	Introduction
7-21	3:10 p.m.	JØRGEN B. THOMSEN	The conservation of birds of prey with special reference to international agreements
7-22	3:25 p.m.	MARGARET E. COOPER	British legislation relating to birds of prey
7-23	3:40 p.m.	PETER J. ROBINSON	Abuse and failure of existing wild bird legislation in Britain and Europe, with particular reference to free-living and captive raptors
7-24	3:55 p.m.	AMOS ENO	Raptor law enforcement problems
7-25	4:10 p.m.	JAMES D. WEAVER	Law enforcement as it relates to falconry
7-26	4:25 p.m.	EDUARDO E. INÍGO ELIAS	The trade of diurnal birds of prey in Mexico
7-27	4:40 p.m.	CARLOS WOTZKOW (to be read by M. Cooper)	A summary of current laws protecting raptors in Cuba

7-15	11:10 a.m. HARRY A. HANCOCK	Britain
7-16	11:22 a.m. JAMES WILLY	West Indies
7-17	11:40 a.m. CLAYTON M. WHITE	Summary of country reports
12:00 noon LUNCH BREAK		
II. SPECIAL REPORT		
7-18	1:00 p.m. WENDY-WILSON WETTER	Threatened and near-threatened birds of prey species of the world
III. ESTABLISHMENT OF PROGRESS FOR FACTORS		
7-19	2:00 p.m. JAMES A. HANCOCK	Discussion
2:45 p.m. BREAK		
IV. SYMPOSIUM ON LEGISLATION AND ENFORCEMENT		
<p>Participants: Peter J. Robinson, Royal Society for the Protection of Birds, The Lodge, Sandy, Bedfordshire SG19 2DL, England and</p> <p>Harcourt E. Cooper, c/o John E. Cooper, Royal College of Surgeons of England, London WC1A 2PW, England</p>		
7-20	2:00 p.m. PETER J. ROBINSON	Introduction
7-21	2:10 p.m. HARCOULT E. COOPER	The conservation of birds of prey with special reference to international agreements
7-22	2:25 p.m. HARCOULT E. COOPER	British legislation relating to birds of prey
7-23	2:40 p.m. PETER J. ROBINSON	Agree and failure of existing wild bird legislation in Britain and Europe, with particular reference to free-living and captive raptors
7-24	2:55 p.m. JOHN E. COOPER	Japan has enforcement problems
7-25	3:10 p.m. JAMES A. HANCOCK	Law enforcement as it relates to falconry
7-26	3:25 p.m. HENRY E. ELIAS	The trade of domestic birds of prey in Mexico
7-27	3:40 p.m. CHAS. DE WITTE	A summary of current laws protecting raptors in Cuba

7-28 4:50 p.m. PETER J. ROBINSON Floor discussion
MARGARET E. COOPER
5:30 p.m. ADJOURN

FRIDAY, NOVEMBER 8, 1985--CALIFORNIA ROOM

V. SYMPOSIUM ON RAPTORS IN TROPICAL RAINFORESTS

Chairman: Jean-Marc Thiollay, Ecole Normale Supérieure, Laboratory de Zoologie, 46 Rue D'ulm, 75230 Paris Cedex 05, France

	8:00 a.m. JEAN-MARC THIOLLAY	Introduction
7-29	8:10 a.m. DAVID C. HOUSTON	The population density of cathartid vultures in neotropical forests and the use of vultures as indicators of forest disturbance
7-30	8:25 a.m. JEAN-MARC THIOLLAY	Changing patterns of raptor communities through successive stages of rainforest exploitation
7-31	8:40 a.m. JORGE ALBUQUERQUE, A.J. Witeck, and Annette Aldous	A roadside count of diurnal raptors in Rio Grande do Sul, Brazil
7-32	8:55 a.m. JACK CLINTON-EITNIEAR	Raptors in the tropical forests of Belize
7-33	9:10 a.m. JAMES WILEY	Raptors in the tropical forests of the West Indies
7-34	9:25 a.m. J. PETER JENNY and Tom J. Cade	Observations on the ecology and behavior of the Orange-breasted Falcon
	9:40 a.m. JEAN-MARC THIOLLAY	Group discussion
	10:00 a.m. BREAK	

VI. GROUP DISCUSSION OF LATIN AMERICAN RAPTOR PROBLEMS

Moderator: Mario A. Ramos, INIREB-CHIAPAS, Real de Guadalupe 55, Apartado Postal 219, San Cristobal de las Casas, Chiapas 29230, Mexico

7-35	10:15 a.m. MARIO A. RAMOS	Introduction
7-36	10:25 a.m. MILTON CAMACHO	Nicaragua

FRIDAY, NOVEMBER 5, 1953--CALIFORNIA HOUSE

V. INTRODUCTION TO THE HISTORY OF TROPICAL RAINFORESTS

Chairman: Jean-Marie Thiollay, Ecole Normale Supérieure, Laboratory of Zoology, 46 Rue d'Ulm, 75001 Paris Cedex 05, France

7-25	8:00 a.m.	JEAN-MARIE THIOLLAY	Introduction
7-26	8:10 a.m.	DAVID C. HOUGHTON	The population density of tropical rainforests in neotropical forests and the use of various indicators of forest disturbance
7-26	8:25 a.m.	JEAN-MARIE THIOLLAY	Changing patterns of tropical rainforests through successive stages of selective exploitation
7-26	8:40 a.m.	JACK ALGOUZAKIS, A. J. WYCK, and RICHARD ALBON	A roadside record of diurnal reptiles in the Grande de Sol, Brazil
7-26	8:55 a.m.	JACK CLINTON-REYNOLDS	Raptors in the tropical forests of Borneo
7-26	9:10 a.m.	JAMES WILLY	Raptors in the tropical forests of the West Indies
7-26	9:25 a.m.	J. PETER JONES and TOM J. COLE	Observations on the ecology and behavior of the Orange-breasted Falcon
	9:40 a.m.	JEAN-MARIE THIOLLAY	Group discussion
	10:00 a.m.	Break	

VI. GREAT DISCOVERY OF LATIN AMERICAN BIRD PROBLEMS

Chairman: Mario A. Gomez, INIBIO-CHIRIQUI, Hotel de Guadalupe 22, Apartado Postal 210, San Cristobal de las Casas, Chiapas, Mexico, Mexico

7-26	10:15 a.m.	MARIO A. GOMEZ	Introduction
7-26	10:30 a.m.	WILLIAM LAMBERT	Discussion

7-37 10:40 a.m. WILLIAM S. CLARK What is Buteo ventralis?

7-38 10:55 a.m. OTHER TOPICS

12:00 noon LUNCH BREAK

VII. GROUP DISCUSSION OF RAPTOR PROBLEMS COMMON TO NORTH AMERICA
AND LATIN AMERICA

Moderators: Mark R. Fuller, U.S. Fish and Wildlife Service, Patuxent
Wildlife Research Center, Laurel, Maryland 20708
and
Richard W. Fyfe, Canadian Wildlife Service, Department of
the Environment, 1000, 9942-108 St., Edmonton, Alberta,
Canada T5K 2I5.

12:30 p.m. MARK R. FULLER Introduction

7-39 TOPIC 1: Contaminants

7-40 TOPIC 2: Illegal trade (further discussion)

7-41 TOPIC 3: Persecution

7-42 TOPIC 4: Environmental assessment and land use

7-43 TOPIC 5: Migrant problems

7-44 OTHER TOPICS FROM THE FLOOR

1:45 p.m. - 3:00 p.m. BREAK

7-45 2:00 p.m. NEWS CONFERENCE--Specific Invitees and Press Only
(Monterey Room)

VIII. CURRENT RAPTOR MANAGEMENT ISSUES IN THE UNITED STATES AND CANADA

Chairman: Patrick C. Benson, Department of Zoology, University of
Witwatersrand, Johannesburg, 2001, Republic of South Africa

3:00 p.m. JOSEPH R. MURPHY Introduction

7-46 3:10 p.m. ROBERT L. PHILLIPS Current issues concerning management
of Golden Eagles in the West

7-47 3:30 p.m. JAMES D. FRASER Raptor management issues in the
eastern United States

7-48 3:50 p.m. PHILIP SCHEMPF Raptor management in Alaska: issues
and answers

7-49 4:10 p.m. JOSEF K. SCHMUTZ Management of raptors in Canada

4:30 p.m. JOSEPH R. MURPHY Discussion

5:30 p.m. ADJOURN

What is being accomplished?

7-27 10:30 a.m. WILLIAM E. CLARK

7-28 10:30 a.m. JOHN TOWNE

11:00 a.m. LUNCH BREAK

VII. GROUP DISCUSSION OF BARTON PROBLEMS KNOWN TO NORTH AMERICA AND LATIN AMERICA

Speakers: Mark D. Folger, U.S. Fish and Wildlife Service, Patuxent Wildlife Research Center, Laurel, Maryland 20708 and Richard W. Fyfe, Canadian Wildlife Service, Department of the Environment, 1000, 95th St., Edmonton, Alberta, Canada T6E 6T5.

12:30 p.m. MARK E. FOLLER Introduction

7-29 TOPIC 1: Contaminants

7-30 TOPIC 2: Illegal Trade (Further discussion)

7-31 TOPIC 3: Veterinary

7-32 TOPIC 4: Environmental assessment and land use

7-33 TOPIC 5: Migrant problems

7-34 OTHER TOPICS FROM THE PAPER

1:45 p.m. - 3:00 p.m. BREAK

7-35 3:00 p.m. BIRD CONFERENCE - Specific Invited and Paper Only (Rotating Room)

VIII. CURRENT BARTON MANAGEMENT ISSUES IN THE UNITED STATES AND CANADA

Speakers: Robert C. Beeson, Department of Zoology, University of Wisconsin, Johannesburg, 2001, Republic of South Africa

3:00 p.m. ROBERT C. BEESON Introduction

7-36 3:10 p.m. ROBERT L. PHILLIPS Current Issues concerning management of Golden Eagles in the West

7-37 3:20 p.m. JAMES A. HANSEN Baptor management issues in the eastern United States

7-38 3:30 p.m. PHILIP SHERIDAN Baptor management in Alaska: Issues and answers

7-39 4:10 p.m. ROBERT E. SHOOTER Management of raptors in Canada

4:30 p.m. ROBERT E. SHOOTER Discussion

5:30 p.m. ADDRESS

* ABSTRACTS *

SESSION 7.

WESTERN HEMISPHERE MEETING OF THE WORLD WORKING GROUP ON BIRDS OF PREY

November 7-8, 1985
Sacramento, California

Hosted by:

The Western Foundation of Vertebrate Zoology
and
Raptor Research Foundation, Inc.

Held in conjunction with the 1985 Raptor Research Foundation Symposium
on the Management of Birds of Prey, International Meeting

Sponsored by:

Bureau of Land Management
California Department of Fish and Game
California Energy Commission
Hawk Mountain Sanctuary Association
Institute for Wildlife Studies
The National Audubon Society
Pacific Gas and Electric Company
The Peregrine Fund, Inc.
Southern California Edison Company
San Francisco Zoological Society
U.S. Fish and Wildlife Service
The Western Foundation of Vertebrate Zoology

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New Mountain Sanctuary Association
California Energy Commission
California Department of Fish and Game
Bureau of Land Management

A roadside count of diurnal raptors in Rio Grande do Sul, Brazil.

JORGE L.B. ALBUQUERQUE (Department of Zoology, Brigham Young University, Provo, Utah 84602. Phone: 801-355-2058), A.J. Witeck (R. Duque de Caxias, 339, Apt. 403, 96200 Rio Grande, RS, Brazil), and Annette Aldous (233 No. Main Apt. 303, Salt Lake City, Utah 84103. Phone: 801-582-5847).

Roadside counts were taken between July 1978 and April 1983 on one road running north-south and one running east-west in the state of Rio Grande do Sul, Brazil. Both roads transverse agricultural land. Analysis of approximately 300 trips shows the annual and seasonal population trends of nine Falconiformes. Eight of these (Elanus leucurus, Buteo magnirostris, Buteogallus meridionalis, Circus buffoni, Polyborus plancus, Milvago chimachima, M. chimango, and Falco sparverius) were residents, and one (Rosthramus sociabilis) was a migrant which breeds in the state. Buteo magnirostris was the dominant species during the nonbreeding season, and Rosthramus sociabilis was dominant during the breeding season.

Reports from the southern Brazilian members of the South American section of the World Working Group on Birds of Prey--a conservation note on raptors from southern Brazil.

JORGE L.B. ALBUQUERQUE (Department of Zoology, Brigham Young University, Provo, Utah 84602. Phone: 801-355-2058).

In 1980 we asked several ornithologists from southern Brazil to give us information on the status of raptors in their study areas. Mr. Pedro Scherer Neto sent good information from his State of Parana on Leucopternis polionota and L. lacernulata, as well as on Buteo leucorhous, Accipiter poliogaster, Micrastur semitorquatus, and M. ruficollis. He recorded these species in the rain forests of east Parana in the Serra do Mar. Mr. Walter Voss recorded Leucopternis polionota in 1979 in one corn field close to Porto Alegre, Rio Grande do Sul. Voss and I recorded Spizaetus tyrannus, Spizartur melanoleucus, Morphnus guianensis, Harpjahliaetus coronatus in sectors in and close to Aparados da Serra National Park. These species are now facing reduction of habitat by coal mining and tobacco crops in the east slopes of Serra do Mar. In the highlands in the top of the Serra exotic forests are now replacing the native one. In spite of the existence of laws protecting endangered species, the recent prohibition of use of organochlorinated pesticides, there is no enforcement. Also in function of the foreign debt that Brazil is facing now, there is a pressure to produce and pay the international banks.

What is Buteo ventralis?

WILLIAM S. CLARK (9306 Arlington Blvd., Fairfax, Virginia 22030. Phone: 703-591-7778).

While on his famous Beagle voyage, Charles Darwin collected a specimen in 1837 of a previously undescribed buzzard in southern Argentina. It was described by Gould as Buteo ventralis, the Rufous-tailed Buzzard. In the 148 years since, few additional specimens were collected, little has been published, and only two nests were described. I have examined 10 immature specimens, including the type, and find them identical in plumage and size to immatures of Buteo jamaicensis, the Red-tailed Hawk. I will review what little is known about its habits and distribution. It is apparently not common and is found in the beech forests of southern South America. Field

work is needed to determine the population status of this apparently rare buzzard. Is it a race of Buteo jamaicensis as Kirk Swann proposed in A Synopsis of the Accipitres (1922)?

Raptor population trends in eastern Mexico and Belize.

JACK CLINTON-EITNIEAR (Belize Zoo, P.O. Box 474, Belize City, Belize, Central America. Phone: 512-631-8757).

Data from five Audubon Christmas Count areas in Mexico and Belize from 1974-84 were analyzed. The large hawk-eagles are most affected by deforestation and other human activities. Other forest raptors, such as the White Hawk and forest falcons were affected to a lesser extent. The numerical status of raptors preferring second growth or disturbed forest is increasing (e.g., Gray Hawk, Roadside Hawk, and Laughing Falcon).

British legislation relating to birds of prey.

MARGARET E. COOPER (c/o J.E. Cooper MRCVS, Royal College of Surgeons of England, London WC2A 3PN England).

Free-living birds of prey are usually covered by conservation or hunting legislation. Many other factors affect those kept in captivity, for example, restrictions on taking from the wild, keeping, sale, import or export, and provisions for their welfare in housing and transport. These factors will be considered in the light of the law of Great Britain.

An overview of raptor biology and conservation in Latin America.

DAVID H. ELLIS (U.S. Fish and Wildlife Service, Patuxent Wildlife Research Center, Laurel, Maryland 20708).

Prior to the last decade, biological studies of raptorial birds in Latin America were, with a few exceptions, nonexistent. For many species all that was known was the general range and habitat type. While the logistical and political challenges are still present, the last few years has seen the opening of a door to what will almost surely be a flood of scientific investigations. From over 40,000 ground miles traveled in 16 countries, field contact with over two thirds of the raptor species, and interviews with conservation officers in 10 nations, I will report on some raptor concentration areas, identify topics for future research, and generalize on raptor conservation issues. I will also briefly mention some recent biological studies and touch briefly on the challenges awaiting the biologist who tries his or her hand at reaping the rewards that are present in abundance for those who engage in raptor studies in Latin America.

Raptor law enforcement problems.

AMOS ENO (National Audubon Society, National Capitol Office, 645 Pennsylvania Avenue, S.E., Washington, D.C. 20003).

This paper will deal with enforcement problems in general, and more specifically, with the raptor exemption of the Endangered Species Act. A proposal for remedial legislative language will also be provided.

work is needed to determine the population status of this apparently rare
bird. It is a case of *Polioptila caerulea* as King (1951) proposed in a
synopsis of the bird (1951).

Recent population trends in eastern Mexico and Belize.
JACK CLAYTON-BLICKER (Belize Zoo, P.O. Box 274, Belize City, Belize,
Central America. Phone: 215-511-8777).
Belize Zoo has studied Central American forest areas in Mexico and Belize from
1950-55. The large bird-watching area was mostly affected by defor-
estation and other human activities. Forest forest regrowth, such as the
White Pine and Forest Reserve were affected to a lesser extent. The
numerical status of various species is being studied in a forested area
in Guatemala (e.g., Grey Heron, House Martin, and Laughing falcon).

Belize legislation relating to birds of prey.
Sergeant J. COOPER (c/o J.E. Cooper, Belize College of Agriculture of
Belize, Belize City, Belize).
Belize has a law of prey and is usually covered by conservation or hunting
legislation. Many other factors affect birds kept in captivity, for
example, restrictions on taking from the wild, keeping, sale, import or
export, and provisions for their welfare in housing and transport. These
factors will be considered in the light of the law of Great Britain.

An overview of recent biology and conservation in Latin America.
DAVID E. BLAIR (c/o J.E. Cooper, Belize College of Agriculture, Belize City,
Belize, Central America, Phone: 215-511-8777).
Prior to the 1950s, biological studies of vertebrate birds in
Latin America were, with a few exceptions, nonexistent. For many species
all that was known was the general range and habitat type. While the
legislation and conservation changes are still present, the last few years
have seen the opening of a door to what will almost surely be a flood of
scientific investigations. From over 40,000 ground birds recorded in 1950
countries, birds recorded with over 100 birds of the raptor species, and
conservation with conservation efforts in 10 nations, I will report on some
recent conservation areas, identify factors for future research, and
generalize on recent conservation issues. I will also briefly mention
some recent biological studies and touch briefly on the challenges meeting
the biologist who takes his or her part in keeping the records that are
present in literature for those who engage in recent studies in Latin
America.

Recent law enforcement problems.
WILLIAM E. BLAIR (Belize College of Agriculture, Belize City, Belize,
Central America, Phone: 215-511-8777).
This paper will deal with enforcement problems in general, and more
specifically, with the recent expansion of the endangered species Act. A
proposal for revised legislative language will also be provided.

Status of raptors in Surinam.

RICHARD W. FYFE (Canadian Wildlife Service, No. 1000, 9942-108 St., Edmonton, Alberta T5K 2J5 Canada).

The variety of birds of prey found in Surinam varies seasonally with the influx of (and later departure of) North American migrants. In the coastal populated area common raptors observed included Black Vultures, Turkey Vultures, Snail Kites, Ospreys, and Yellow-headed Caracaras, plus occasional sightings of Peregrine Falcons, Bat Falcons, and Laughing Falcons. In the interior rainforest we frequently observed Swallow-tailed Kites, Yellow-headed Vultures, and Bat Falcons.

The status of raptors in Panama.

NATHAN GALE (The Center for Propagation of Endangered Panamerican Species, PSC Box 973, Albrook, APO Miami, Florida 34005).

Raptors in a protected area of Panama jungle have increased in recent years. In nonprotected areas they appear to be stable or are decreasing in numbers. The recent establishment of national parks and other reserves and the formation of organizations to assist in conservation efforts indicated a growing interest by Panamericans in their environment. The degree of international assistance to these organizations to ensure their success during the next one to three years will determine the future of wildlife in Panama.

The population density of cathartid vultures in neotropical forests and the use of vultures as indicators of forest disturbance.

DAVID C. HOUSTON (Department of Zoology, University of Glasgow, Glasgow G12 8QQ, Scotland. Phone: 0044 339 8855).

The cathartid vultures feed almost exclusively by scavenging. The mammal populations of undisturbed tropical forests provide a large food supply for scavengers, much of which is taken by vultures. These birds are among the most abundant birds of prey in forest habitats. But, because of their dependence on large mammal populations, they are sensitive to forest disturbance. There is a good correlation between vulture density and mammalian biomass.

The status of raptors in Guatemala.

JORGE A. IBARRA (Museo Nacional de Historia Natural, Apdo. Postal 987, Guatemala City, Guatemala, Central America).

The forthcoming inauguration of the National Ecology and Natural History Museum of Guatemala and the protection of birds of prey, figure among the most important exhibits. In the Mayan glyphs, eagles, hawks, and vultures appear as those birds which held special interest throughout prehistoric times and, therefore, were spared from harassment or persecution. Mention is made of a temple devoted to the eagle owl. Beliefs and superstitions have distorted the ecological activity of these birds which are regarded as man's enemies. The widespread saying among the provinces of Guatemala that: "When the owl hoots the indian dies," has become a threat to their lives. Popular songs have also contributed to create deplorable concepts regarding the activity of these birds, disregarding the useful and

State of reports in Britain.
 RICHARD W. FINE (Canadian Wildlife Service, Box 1000, 9902-100 St.,
 Edmonton, Alberta T6C 2T5 Canada).
 The variety of birds of prey found in Britain varies seasonally with
 the influx of (and later departure of) North American migrants. In the
 coastal provinces there common raptors observed included Black Vultures,
 Turkey Vultures, Great Horned Owls, Ospreys, and Yellow-headed Vultures, plus
 occasional sightings of Peregrine Falcons, Red Falcons, and Laughing
 Falcons. In the interior provinces we frequently observed Yellow-tailed
 Black, Yellow-headed Vultures, and Red Falcons.

The status of reports in Panama.
 RICHARD W. FINE (The Center for Propagation of Endangered Panamanian
 Species, Box 215, Albrook, Panama 06012-2150).
 Panama is a protected area of Panama. It has been increased in recent
 years. In unprotected areas they appear to be stable or are decreasing
 in numbers. The recent establishment of national parks and other reserves
 and the formation of organizations to assist in conservation efforts
 has resulted in a growing interest by Panamanians in their environment. The
 success of international assistance to these organizations to ensure their
 success during the next one to three years will determine the future of
 wildlife in Panama.

The population density of vulturids vultures in neotropical forests and
 the use of vultures as indicators of forest disturbance.
 DAVID C. BOWEN (Department of Zoology, University of Guelph, Guelph,
 Ont. N1G 2W1, Canada. Phone: (519) 865-5555).
 The neotropical vultures feed almost exclusively by scavenging. The
 mammal populations of undisturbed tropical forests provide a large food
 supply for vultures, much of which is taken by vultures. These birds
 are among the most abundant birds of prey in forest habitats. But, because
 of their dependence on large mammal populations, they are sensitive to
 forest disturbance. There is a good correlation between vulture density
 and mammalian biomass.

The status of reports in Guatemala.
 ROBERT A. IZABE (Museo Nacional de Historia Natural, Apdo. Postal 987,
 Guatemala City, Guatemala, Central America).
 The forthcoming inauguration of the National Zoology and Natural History
 Museum of Guatemala and the protection of birds of prey, figure among the
 most important activities in the Guatemalan vulture, hawk, and falcon
 groups. In these birds which hold special interest throughout Guatemala
 since and therefore, were spared from harassment or persecution. Mention
 is made of a temple devoted to the eagle owl. Beliefs and superstitions
 have distorted the ecological activity of these birds which are regarded
 as man's enemies. The widespread saying among the provinces of Guatemala
 that "God has made the falcon blind," has become a threat to their
 lives. Popular songs have also contributed to create favorable concepts
 regarding the activity of these birds. Regarding the useful and

important function they display in our forests in benefit of man. The erroneous ideas held by farmers and peasants is that birds of prey hover around their fields only in search of poultry or newborn calves. The destruction of forests is one of the most severe problems in need of urgent solution in order to avoid the irreversible loss of valuable species. A continuous and persistent educational campaign to create awareness regarding the industrious activity of birds of prey is necessary. The first ecological narratives are being published in Guatemala. Strict laws should be implemented for the protection of these birds.

The trade of diurnal birds of prey in México.

EDUARDO E. IÑIGO ELIAS (Instituto Nacional de Investigaciones sobre Recursos Bioticos, Real de Guadalupe No. 55, Apartado Postal 219, San Cristobal de las Casas 29200, Chiapas, México).

Mexico, like other areas of the world, has serious problems with the survival of raptors given the rapid rate of forest destruction, chemical pollution, and wildlife trade. The wildlife trade has increased during the last five years, mostly at the national level. This work presents data on the raptor trade in Mexico City between June 1983 and May 1985; it includes data collected on one of the main capture sites gathered in 1980 and 1983 in San Luis Potosi, and it summarizes the data available between 1980-1983 and 1985 on exportation of birds of prey to other countries of the world. I conclude that the trade is having major effects on the populations of Mexican raptors, being one of the principal factors contributing to their decline. Stronger protection measures would have to be taken in Mexico and other parts of the world to ensure their survival and conservation.

Status of raptors in Chile.

FABIAN M. JAKSIC (Depto. Biología Ambiental, Universidad Católica de Chile, Casilla 114-D, Santiago, Chile).

Observations on the ecology and behavior of the Orange-breasted Falcon (Falco deiroleucus).

J. PETER JENNY and Tom J. Cade (The Peregrine Fund, Inc., Laboratory of Ornithology, 159 Sapsucker Woods Road, Ithaca, New York 14850).

A series of nine field trips between January of 1979 and May of 1983 in Belize, Guatemala, Ecuador, and Peru to locate breeding pairs of Orange-breasted Falcons resulted in observations at seven nests and provided hitherto unrecorded data on distribution, predatory behavior, and breeding biology. During this investigation, Orange-breasted Falcons were only found at elevated locations overlooking vast stretches of uncut climax forest. It appears from these preliminary findings that deforestation may pose the most significant threat to this highly specialized raptor.

important function they display in our forests in benefit of man. The enormous damage done by locusts and grasshoppers to birds of prey power would result in the loss of poultry or newborn calves. The destruction of forests is one of the most serious problems in need of urgent solution in order to avoid the irreversible loss of valuable species. A continuous and persistent educational campaign to create awareness regarding the ecological activity of birds of prey is necessary. The first ecological awareness are being published in Guatemala. Efforts have been made to implement for the protection of these birds.

The study of diurnal birds of prey in Mexico. EDUARDO E. RUIZ ELIAS (Instituto Nacional de Investigaciones Superiores, Avenida Hidalgo, No. 25, Apartado Postal 115, San Cristobal de las Casas 29000, Chiapas, Mexico). Mexico, like other areas of the world, has various problems with the survival of various species. The rapid rate of forest destruction, chemical pollution, and wildlife trade. The wildlife trade has increased during the last five years, mostly at the national level. This work presents data on the recent trade in Mexico City between June 1983 and May 1985; it includes data collected on one of the main markets since gathered in 1980 and 1983 in San Luis Potosi, and it summarizes the data available between 1980-1983 and 1985 on exportation of birds of prey to other countries of the world. I conclude that the trade is having major effects on the balance of Mexican regions, being one of the principal factors contributing to their decline. Stronger protection measures would have to be taken in Mexico and other parts of the world to ensure their survival and conservation.

Report of capture in Chile. FERNAN E. LARSEN (Departamento Biológico, Universidad Católica de Chile, Casilla 134-4, Santiago, Chile).

Observations on the ecology and behavior of the Orange-breasted Falcon (*Elanoides forficatus*). J. PETER JONES and J. A. GALT (The Peregrine Fund, Inc., Laboratory of Ornithology, 100 Spencer Woods Road, Ithaca, New York 14850). A series of nine birds were captured between January of 1979 and May of 1982 in Belize, Guatemala, Honduras, and Peru to locate breeding pairs of Orange-breasted Falcons resulted in observations at three nests and provided detailed information on distribution, predatory behavior, and breeding biology. During this investigation, Orange-breasted Falcons were only found at elevated locations overlooking vast stretches of scrubby forest. It appears from these preliminary findings that deforestation may pose the most significant threat to this highly specialized species.

Causes which affect the survival of birds of prey in Nicaragua.

JUAN C. MARTINEZ-SANCHEZ (Museo de Zoologia, IRENA, Box 5123, Managua, Nicaragua. Phone: 31110 ext. 227).

In this report I present a general analysis of the factors which affect the maintenance of the habitats for the birds of prey in Nicaragua, although without information on the specific status of the species involved. This matter is not the object of specific studies at this moment. In my opinion the populations of the birds of prey in the Pacific region are seriously threatened because of deforestation and the pollution of their habitats and food by pesticides. In the Central region the pesticide situation is less dangerous, but the area with deforested land continues increasing rapidly. The military situation in the Atlantic region has stopped the advance of the agricultural frontier and logging activities. These problems, in conjunction with the low population density, produce a conjectural conservation situation for the habitats of birds of prey in this region. The sport hunting and trade of these birds occurs at a very reduced level. The reasons are, in the first case, the high prices of ammunition and, in the second case, because these birds do not arouse much interest by the local population. This lack of interest is reflected in the ambiguity of the current legislation and unawareness of it by the same authorities who are responsible for making the people observe them.

Threatened and near-threatened birds of prey species of the world.

BERND U. MEYBURG (World Working Group on Birds of Prey, Herbert-Str. 14, D-1000 Berlin 33, Federal Republic of Germany. Phone: 4930-8254131).

One of the most important tasks of the World Working Group on Birds of Prey of the ICBP is to collect adequate information on the status of raptor species throughout the world, to identify those species and races which are threatened with extinction or endangered, and to establish priorities and measures for their conservation. In particular, the World Working Group's attention is focussed on those species which have received little attention or are little known and for which there appears little likelihood of attention and support from elsewhere. A "Red List" is being prepared of the rarest and most endangered species of raptors throughout the world, following the categories laid down in the Red Data Book of IUCN of "Extinct," "Endangered," "Vulnerable," "Rare," "Indeterminate," "Insufficiently Known," "Out of Danger," and "Of Special Concern." Information is being collected as far as possible on status, threats, and conservation measures.

Notes on the status of raptor populations in Ecuador.

FERNANDO I. ORTIZ-CRESPO (Department of Natural Sciences, University of the Sacred Heart, Box 12383 Loiza Sta., Santurce, Puerto Rico 00914).

While raptor populations east of the Andes remain relatively safe, those in the inter-Andean valleys and west of the Andes have been drastically reduced, mainly because of deforestation and the concomitant fall in prey species populations. A Harpy Eagle specimen now in the University of Miami, obtained six years ago, could be the last record of this species from western Ecuador, where monkeys, sloths, and other arboreal mammals have nearly disappeared. A similar situation is affecting

other large birds of prey there. Widespread use of pesticides for raising export crops is another source of danger for all raptors except those in areas that have not been altered by intensive cultivation. While the Andean Condor and other open-country vultures are not uncommon, forest-dwelling cathartids are declining in response to habitat destruction. The best hope for continuing survival of the 5 vulture and 62 hawk and falcon species found in Ecuador is the National Park and Natural Area Administration System, but this government service is understaffed and otherwise limited in resources.

Current issues concerning management of Golden Eagles in the West.

ROBERT L. PHILLIPS (U.S. Fish and Wildlife Service, Denver Wildlife Research Center, Box 916, Sheridan, Wyoming 82801. Phone: 307-672-5826).

This paper presents an overview of the problems facing eagles, primarily goldens, during the 1980s in the western United States. Electrocution, illegal shooting, and poisoning continue to be the major causes of eagle mortality. Continuing cooperative efforts between government and industry appear to be lessening the impact of the electrocution problem in many areas. Conservation education and law enforcement activities are credited with reducing mortality from shooting and poisoning. Increased demand for eagle feathers and other parts by American Indians has posed new problems for law enforcement officials. The most serious problem facing eagles today is the reduction of nesting and hunting habitats associated with an expanding human population. Accelerated development of western energy reserves has caused many conflicts with raptors, but most of these have been resolved through successful mitigation efforts.

Status of the birds of prey in Mexico.

MARIO A. RAMOS (Instituto Nacional de Investigaciones Sobre Recursos Bioticos (INIREB), Real de Gpe. 55, San Cristobal, Chiapas, 29200, Mexico).

In this paper I briefly review the status of the birds of prey in Mexico. Major threats such as habitat modification, pollution, trade, and hunting are identified. Overlapping of migratory and resident populations obscure the status of some species. Twenty-seven species are considered threatened in Mexico. The legislation does not respond to the protection needs of these species. Alternatives for conservation of raptors are included.

Abuse and failure of existing wild bird legislation in Britain and Europe, with particular reference to free-living and captive raptors.

PETER J. ROBINSON (The Royal Society for the Protection of Birds, The Lodge, Sandy, Bedfordshire, SG19 2DL, England. Phone: 0767 80551).

On the premise that the true test of any piece of legislation lies in whether or not it achieves what government intended, the effectiveness of raptor legislation is analyzed, mainly in Britain but also for other countries. Comparisons are drawn with North America. Areas of failure are identified and shown to be common between countries. Methods of enforcement vary between countries but none in Europe appears to have

other large birds of prey there. Wilderness was of pesticides for raising export crops is another source of danger for all raptors except those in areas that have not been altered by intensive cultivation. While the Hudson River and other open country habitats are not uncommon, forest-dwelling raptors are declining in response to habitat destruction. The best hope for continuing survival of the 5 vulture and 65 hawk and falcon species found in the National Park and Natural Area Administration system, but this government service is understaffed and otherwise limited in resources.

Current issues concerning management of Golden Eagles in the West. ROBERT J. WILLIAMS (U.S. Fish and Wildlife Service, Denver Wildlife Research Center, Box 256, Fort Collins, Wyoming 80521. Phone: 303-675-7825). This paper presents an overview of the problems facing eagles, particularly Golden Eagles, in the western United States. Electrocution, illegal shooting, and poisoning continue to be the major causes of eagle mortality. Continuing cooperative efforts between government and industry appear to be lessening the impact of the electrocution problem in many areas. Conservation education and law enforcement activities are needed to reduce mortality from shooting and poisoning. Increased demand for eagle feathers and other parts by American Indians has posed new problems for law enforcement officials. The most serious problem facing eagles today is the reduction of nesting and breeding habitats associated with an expanding human population. Accelerated development of western energy resources has caused many conflicts with raptors, but most of these have been resolved through successful mitigation efforts.

Status of the birds of prey in Mexico. WALTER A. WATTS (Instituto Nacional de Investigaciones sobre Recursos Naturales (INIREN), P.O. Box 25, San Cristobal, Chiapas, 29000, Mexico). In this paper I briefly review the status of the birds of prey in Mexico. Major threats such as habitat modification, pollution, trade, and hunting are identified. Overlapping of migratory and resident populations obscures the status of some species. Twenty-seven species are considered threatened in Mexico. The legislation does not respond to the protection needs of these species. Alternatives for conservation of raptors are included.

Above and below of existing wild bird legislation in Britain and Europe, with particular reference to free-living and captive raptors. PETER J. BULLOCK (The Royal Society for the Protection of Birds, The Lodge, Sandy, Bedfordshire, MK43 0DL, England. Phone: 0454 60321). On the premise that the time test of any piece of legislation lies in whether it not it addresses what government intended, the effectiveness of raptor legislation is compared, mainly in Britain but also for other countries. Comparisons are drawn with North America. Areas of failure are identified and shown to be common between countries. Methods of enforcement vary between countries but none in Europe appears to have

government agencies comparable with those in North America. The concept of international bird treaties is a recent one in Europe! "Cross-border" abuse is also considered. Raptors suffer from the attentions of various interests, thereby putting them at greater risk than many other species.

Changing patterns of raptor communities through successive stages of rain forest exploitation.

JEAN-MARC THIOLLAY (Department of Zoology, E.N.S., 46 rue d'Ulm, 75005 Paris, France. Phone: 011 331-329 1225).

Falconiform communities were studied within five increasingly disturbed forest habitats in Ivory Coast and French Guiana. Similar changes occurred in species turnover rates, population structure, and ecological adaptations. Losses of primary forest species and conservation strategy are discussed.

The conservation of birds of prey with special reference to international agreements.

JØRGEN B. THOMSEN (Ministry of the Environment, National Agency for the Protection of Nature, Monuments and Sites, Fredningsstyrelsen, Amaliegade 13, DK-1256 København K., Denmark. Phone: +456 1 119565).

This paper briefly deals with the Convention on international trade in endangered species of wild fauna and flora, the Convention on the conservation of migratory species of wild animals, the Convention for the protection of the world cultural and natural heritage, and the Convention on the conservation of European wildlife and natural habitats, as a tool for the conservation of birds of prey. Furthermore, the paper deals with the different agreements of the European Economic Community which involve conservation of birds of prey.

Status of raptors in Peru.

MICHAEL P. WALLACE (Greater Los Angeles Zoo Association, 5333 Zoo Drive, Los Angeles, California 90027. Phone: 213-666-4650).

Between May 1980 and August 1984 I spent a total of 3 years in Peru researching cathartid vultures and condors. Six species of "guano" producing sea birds and endangered species, such as the Andean Condor and the white-winged guan, are fully protected, but most raptor species are not except in preserves. Outside these areas there is little protection for raptors. Fortunately few campesinos hunt. Superstition and the remoteness of roosting and nest sites help protect some species of raptors, while more accessible lowland species frequently appear in the marketplace for sale. Development of foraging habitat remains the most significant threat for raptor populations. Extreme climate changes such as the 1982-83 El Niño can positively affect population levels of some raptor species.

Government agencies comparable with those in North America. The concept of international bird treaties is a recent one in Europe. "Europe-border" is also mentioned. Reports reflect the attention of various international, thereby making them as greater risk than many other species.

Changing patterns of report compilation through successive stages of risk

1980-1981 (Department of Ecology, E.W.S., 46 rue d'Ulm, 75002 Paris, France. Phone: 01 33-1 337 1232).

European committees were studied within five taxonomically distributed forest habitats in Italy, France and Germany. Similar changes occurred in species composition, population structure, and ecological status. Some factors of primary forest species and conservation status are discussed.

The conservation of birds of prey with special reference to international

Agreement. J. THOMSEN (Ministry of the Environment, National Agency for the Protection of Nature, Høvedsvej 1, 2100 Copenhagen, Denmark. Phone: 445 1 1125).

This paper deals with the Convention on International Trade in Endangered Species of Wild Fauna and Flora, the Convention on the Conservation of Wild Animals, the Convention for the Protection of the World Cultural and Natural Heritage, and the Convention on the Conservation of European Wildlife and Natural Habitats, as a tool for the conservation of birds of prey. Furthermore, the paper deals with the different agreements of the European Economic Community which involve conservation of birds of prey.

Season of capture in birds. MICHAEL P. WILSON (Director Los Angeles Zoo Association, 5121 Los

Boulevard, Los Angeles, California 90027. Phone: 213-466-4510).

Between May 1980 and August 1981 I spent a total of 5 years in Peru researching neotropical avian and mammal. Six species of "quana" (including two birds and endangered species, such as the Andean Condor and the white-winged guanaco, are fully protected, but most report species are not always in protection. Outside these areas there is little protection for neotropical. Fortunately few neotropical birds are species of neotropical of neotropical and most birds help protect some species of neotropical. While some neotropical lowland species frequently appear in the neotropical lowland. Development of logging habitat remains the most significant threat for report populations. Extreme climate changes such as the 1982-83 El Niño can positively affect population levels of some report species.

JAMES D. WEAVER (The Peregrine Fund and North American Falconers' Association, 159 Sapsucker Woods Road, Ithaca, New York 14850)

Status and conservation of raptors in the West Indies.

JAMES W. WILEY (Puerto Rico Field Station, Patuxent Wildlife Research Center, Apartado 21, Palmer, Puerto Rico 00721. Phone: 809-753-4936).

West Indian ecosystems have undergone extensive changes since the arrival of European man almost 500 years ago. Massive deforestation, introduced predators and competitors, and shooting are major reasons for declines in West Indian bird populations. Several raptor species are of particular concern, including the Cuban and Grenadan populations of the Hook-billed Kite and Snail Kite; the Cuban, Hispaniolan, Puerto Rican races of the Sharp-shinned Hawk, Gundlach's Hawk, Ridgway's Hawk, Puerto Rican Broad-winged Hawk, and Newton's Screech-owl; and Lesser Antillean populations of the Burrowing Owl, Stygian Owl, and Jamaican Owl. Wintering populations of the Merlin the the Peregrine Falcon continue to accumulate persistent pesticides in the West Indies where these chemicals are not controlled. The Puerto Rican Short-eared Owl was formerly considered close to extinction, but has recently become more numerous and widespread. Status, threats, and conservation efforts are discussed for these raptors.

Cuban legislation relating to birds of prey.

CARLOS WOTZKOW (Calle K 15016, E-7Y D, Alta Habana, Ciudad de la Havana 8, Cuba).

There were no laws relating to birds of prey prior to 1959. At the present time comprehensive laws on conservation and hunting are being formulated. In the meantime strict controls are operated on the taking, for sport or other purposes, of wildlife, including birds of prey. Falconry is permitted only in individual cases, and special permits are required to take birds for that purpose. The Cuban Ornithological Society and Society of Biological Science discourage the concept of import and export and promote the captive breeding of falconiform species.

History and conservation of raptors in the West Indies. JAMES D. MEYER (Peregrine Field Station, Patuxent Wildlife Research Center, Aqueduct II, Palmer, Puerto Rico 00751, Phone: 509-755-4936). West Indian ecosystems have undergone extensive changes since the arrival of Europeans and almost 500 years ago. Massive deforestation, introduced predators and competitors, and shooting are major reasons for declines in West Indian bird populations. Several raptor species are of particular concern, including the Cuban and Greenish populations of the Black-billed Tite and Sharp-shinned Hawk, the Cuban, Hispaniolan, Puerto Rican, and Virginian populations of the Sharp-shinned Hawk, the Cuban, Hispaniolan, and Virginian populations of the Broad-winged Hawk, and the Cuban, Hispaniolan, and Virginian populations of the White-throated Sparrow. The Peregrine Falcon is the most common raptor in the West Indies where these species are not controlled. The Puerto Rican Sharp-shinned Hawk was formerly considered common to extinction, but has recently become more numerous and widespread. Status, threats, and conservation efforts are discussed for these raptors.

Cuban legislation relating to birds of prey. JAMES D. MEYER (Peregrine Field Station, Patuxent Wildlife Research Center, Aqueduct II, Palmer, Puerto Rico 00751, Phone: 509-755-4936). At the present time comprehensive laws on conservation and hunting are being formulated. In the meantime strict controls are operated on the taking, for sport or other purposes, of wild birds, including birds of prey. Penalties are levied only in individual cases, and special permits are required to take birds for that purpose. The Cuban Ornithological Society and the Cuban Ornithological Society are the contact of import and export and promote the captive breeding of falconiform species.

1985 RAPTOR RESEARCH FOUNDATION

SYMPOSIUM ON THE MANAGEMENT OF BIRDS OF PREY

INTERNATIONAL MEETING

Thursday, November 7
International Symposium on Raptor Reintroduction



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* ABSTRACTS *

SESSION 8.

INTERNATIONAL SYMPOSIUM ON RAPTOR REINTRODUCTION

November 7, 1985
Sacramento, California

Hosted by:

The Institute for Wildlife Studies

Held in conjunction with the 1985 Raptor Research Foundation Symposium
on the Management of Birds of Prey, International Meeting

Sponsored by:

Bureau of Land Management
California Department of Fish and Game
California Energy Commission
Hawk Mountain Sanctuary Association
Institute for Wildlife Studies
The National Audubon Society
Pacific Gas and Electric Company
The Peregrine Fund, Inc.
Southern California Edison Company
San Francisco Zoological Society
U.S. Fish and Wildlife Service
The Western Foundation of Vertebrate Zoology

Twenty-five years of reintroduction of the Eagle Owl (Bubo bubo) in Europe.

WILHELM BERGERHAUSEN (Initiative for Reintroduction of the Eagle Owl, Im Düstal 2, 5168 Nideggen, West Germany. Phone: 02427-6521), Björn Broo (Naturhistoric Museum, Box 7283, 40235 Göteborg, Sweden), and Karl Radler (Department of Forestry Genetics, University of Göttingen, 3400 Göttingen, West Germany. Phone: 0551-393532).

History and status of one of the most extensive reintroduction programs in Europe is presented. This included several hundreds of captive breeding pairs and more than 2,000 juvenile birds, which have been released using four different techniques. During 1984 more than 50 breeding pairs have been reported. Their nesting success averaged less than two fledglings per pair. Poles of power lines and car traffic have been recognized as prevailing factors of mortality. Less than 50 percent of the birds released survive the first year of life, which tends to be less than for wild hatched owls. Donor sources are private persons and firms, as well as state governments.

Cross-fostering in birds of prey: a review.

DAVID M. BIRD (Macdonald Raptor Research Centre of McGill University, 21,111 Lakeshore Road, Ste. Anne de Bellevue, Quebec, Canada H9X 1C0. Phone: 514-457-2000).

Cross-fostering, or the act of fostering one species to another, has been successful in the following combinations: falcon to accipiter, falcon to falcon, and falcon to buteo. No follow-up was done as to subsequent mate choices in these birds. Laboratory choice tests with American Kestrels (Falco sparverius) and Eurasian Kestrels (F. tinnunculus) showed that approximately 50% of the mate preferences by either species was in favor of the foster parent type, whether the falcons were raised with or without conspecific siblings, and whether placed in the nest at 1 day or 3 weeks of age. The data suggest that the sensitive period of imprinting in raptors may be late in the nestling stage and may even carry on after fledging. Further experimentation with two common raptor species having overlapping ranges is needed to supplement the laboratory work.

Evaluation of the effects of egg removal on the nesting success and productivity of Southern Bald Eagles.

MICHAEL W. COLLOPY and John L. Roser (Department of Wildlife and Range Science, University of Florida, Gainesville, Florida 32611. Phone: 904-392-4851).

During fall 1984 we began a two-year pilot study in northern Florida to determine if recycling occurred at Bald Eagle nests from which clutches were removed and if this activity affected subsequent nesting success. Aerial surveys were conducted over two study areas at approximately weekly intervals from nest building through hatching, and biweekly thereafter until fledging. Clutches from nine eagle nests were removed on 28-30 December 1984. All nine eagle pairs recycled, with six returning to the same nests and three to alternate nests. Recycling intervals averaged 32.4 days (range 22-57 days). There was no significant relationship between age of eggs and recycling interval ($P > 0.05$). At the nine experimental nests, first clutches averaged 2.1 eggs; estimates of second

clutches averaged 1.8 eggs; and productivity was 1.22 young/active nest. No significant difference ($P > 0.05$) in productivity was found between the 9 experimental and 31 control (1.19 young/active nest) nests.

Effects of chick removal on a donor population of Bald Eagles (Haliaeetus leucocephalus).

JOHN I. HODGES (U.S. Fish and Wildlife Service, P.O. Box 1287, Juneau, Alaska 99802. Phone: 907-586-7243).

Removing chicks from the nests of raptors is an act of extreme predatory disturbance, especially when the entire clutch is taken. Most chick removal projects have been limited in scope, allowing only analysis of the effects on individual adult pairs, but not the population. In Alaska 134 Bald Eagle chicks (65% of production) were removed from an experimental area over a period of five years. Follow-up productivity surveys were conducted by helicopter during incubation and at mid-season when eaglets were 2 to 7 weeks of age. A control area was surveyed without removal of young. The experimental and control areas exhibited highly correlated productivity rates for the first three years indicating no effects from the removals. The experimental area then increased from 39 young in 1984 to 45 young in 1985, while the control area declined from 26 to 16 young.

U.S. Fish and Wildlife Service reintroduction policy for endangered and threatened raptors.

DANIEL L. JAMES (U.S. Fish and Wildlife Service, 1000 N. Glebe Road, Suite 500, Arlington, Virginia 22201. Phone 703-235-2760).

In 1982 the Service adopted a Bald Eagle Translocation Policy that required a detailed assessment of the project site and a statement of the long-range goals and objectives of the project, outlined levels of agency coordination and responsibility, and identified a project priority system for apportioning the eagles available from various donor sources. This paper also discusses Service policies concerning the use of exotic species (or subspecies), introductions outside of historic range, as well as regulations regarding experimental populations and the reclassification of the Arctic Peregrine.

Reintroduction of the White-tailed Sea Eagle (Haliaeetus albicilla) to Scotland.

JOHN A. LOVE (Nature Conservancy Council, 9 Culduthel Road, Inverness, Scotland, United Kingdom IV2 4AG. Phone 0463-239431).

The White-tailed Sea Eagle was exterminated in Britain by 1916. It has not been able to recolonize naturally, and two brief attempts at reintroduction in the 1960s were unsuccessful. This current project was initiated in 1975 by the Nature Conservancy Council, a government conservation body. In subsequent years considerable surveillance has been provided by the Royal Society for the Protection of Birds. Each year from 4 to 10 eaglets, nearly fledged, have been imported from Norway to the Isle of Rhum, a nature reserve 15 miles off Scotland's west coast. By the end of 1985, eighty-two birds had been released. Only 7 are known to have died in the

wild, and about 70-80% are still accountable within a 50-mile radius of Rhum. The first nesting attempts were made in 1981, and eggs were laid in 1983 and 1984. The most experienced pair successfully fledged a chick in 1985. Additional pairs are becoming established, and about half of the imported eagles have yet to mature. Although no further importations are planned, the Irish Wildbird Conservancy hopes to begin a similar project in southwest Ireland.

Reintroduction and its role in the management of raptors.

IAN NEWTON (Institute of Terrestrial Ecology, Monks Wood Experimental Station, Abbots Ripton, Huntingdon, Cambs. PE17 2LS United Kingdom).

My aim is to set the scene for later, more detailed discussion on reintroduction projects. The circumstances in which reintroduction is worthwhile will be defined and discussed in relation to other management options. The problems of prior habitat assessment, the provenance of the release stock, methods of release, and subsequent population dynamics will be discussed. Finally, appropriate criteria for monitoring the step-by-step success of reintroduction projects will be suggested.

A review of Bald Eagle hacking projects and early results in North America.

PETER NYE (New York State Department of Environmental Conservation, Delmar, New York 12054. Phone: 518-439-7635).

Fifteen states within the United States and one Canadian Province are or have been involved in hacking projects for the release of young Bald Eagles into suitable ranges. The objectives of these projects are to restore varying numbers of pairs of breeding Bald Eagles in the chosen release areas. The earliest hacking project began in 1976, and through 1985 over 300 eagles have been hacked at over 20 locations in North America, mostly within the eastern United States. Eagles for these programs are obtained primarily from a variety of wild donor populations in addition to a small percentage from captive breeding facilities. Methodologies used in the hacking process have become fairly standardized. Early results are now becoming available on mortality rates and causes and survivorship to sexual maturity of hacked eagles. Very preliminary results are also being accrued on dispersal distances to ultimate nesting locations, age to first breeding, mate selection, and reproductive capability of hacked Bald Eagles.

Identifying potential Bald Eagle nesting habitat: a review of the state of the art.

KAREN STEENHOF (Snake River Birds of Prey Research Project, U.S. Bureau of Land Management, 3948 Development Avenue, Boise, Idaho 83705. Phone: 208-334-9277).

Reintroduction programs are based on the premise that raptors will return to nest in the general vicinity of the release area. Habitat suitability at the release site may be an important factor that influences the success of a reintroduction effort. The problem of identifying suitable nesting habitat is not unique to reintroduction programs; it is also applicable to areas where habitat is being protected for populations that

are recovering naturally. Using Bald Eagles as a case study, I review the procedures that have been used to evaluate potential nesting habitat, both in reintroduction programs and general management efforts. I then propose a framework for future evaluations that includes assessments of disturbance factors, nest site availability, and foraging opportunities.

Surviving bottlenecks: demographic and genetic issues associated with translocating and reintroducing raptors.

STANLEY A. TEMPLE (Department of Wildlife Ecology, University of Wisconsin, Madison, Wisconsin 53706. Phone: 608-263-6827), Tom J. Cade, and V.J. Hardaswick (Cornell Laboratory of Ornithology, 159 Sapsucker Woods Road, Ithaca, New York 14850. Phone: 607-256-5056).

Translocation of raptors between wild populations and reintroduction of raptors bred in captivity into both vacant and occupied range in the wild have become acceptable conservation strategies. Programs involving these procedures have been either seriously proposed or actually implemented for almost 30 species. There are demographic and genetic issues associated with these procedures, and many of these issues center on the challenges of successfully bringing a managed population through severe demographic and genetic bottlenecks. We will examine these challenges, in both theoretical and practical terms, as they are illustrated by several active raptor management efforts: the translocations of Bald Eagles between regional populations, the reintroduction of captive-bred Peregrine Falcons into vacant range in the eastern United States, and the possible reintroduction of captive-bred California Condors to the wild in the future. We present models describing how introgression of genes from translocated raptors into an extant population varies with respect to the relative proportions of translocated and local individuals and the initial genetic dissimilarities between them. We assess Bald Eagle translocations on the basis of these models and conclude that these translocations have no identifiable theoretical genetic drawbacks. Using pedigree records of Peregrine Falcons reintroduced into vacant range in the eastern United States, we analyze the probable genetic characteristics of the founding population and discuss the long-term implications for the new population that will be derived from these reintroductions. Finally, we examine the future of the California Condor by describing the major bottlenecks associated with the present captive population and future reintroductions. We make a priori suggestions about how the condor population could be managed to minimize potential problems. We discuss the implications of these three case histories for other raptor conservation programs.

Comparisons between methods for releasing raptors and vultures.

MICHAEL P. WALLACE and Stanley A. Temple (Department of Wildlife Ecology, University of Wisconsin, Madison, Wisconsin 53706. Phone: 608-263-6827).

The systematic relationships between the Cathartidae and the other members of the order Falconiformes have been questioned. Behavioral and ecological differences are marked; evolution of raptors has been strongly shaped by the need to capture elusive living prey, whereas in vultures evolution has favored the development of skills for locating carcasses.

The patchy food resources utilized by vultures may be rich, but they are widely dispersed, ephemeral, and unpredictable in spatial and temporal occurrence. As a result, vultures are more gregarious than raptors. Young vultures must interact frequently with other individuals, and to do so they must learn social signals that aid in locating food and competing for access to it after a carcass has been located. We have released 15 Black Vultures (Coragyps atratus), 18 Turkey Vultures (Cathartes aura), and 11 Andean Condors (Vultur gryphus) under various experimental conditions. We describe the methods that led to the successful integration of released vultures into wild populations and compare them with methods used successfully for releasing raptors.

Lammergeier (Gypaetus barbatus): reintroduction into the Alps.

WINFRIED WALTER (World Wildlife Fund/Austria, A-1162 Vienna, Postfach 1, Austria. Phone: 0222/46 14 63).

The reintroduction program of the Lammergeier into the Alps, carried out by the Frankfurt Zoological Society and the World Wildlife Fund, is reaching the final stage. Nearly all Lammergeiers of the subspecies G. b. aureus being kept in zoos have been incorporated in the project. In the Vienna breeding center pairs have been formed and have partly been redistributed to collaborating zoos. Today 5 reproducing pairs provide up to 7 young vultures annually. Following a public relations campaign, the release of young birds in groups of 3 to 5 will start in 1986 in the Austrian Alps where the species was exterminated during the last century.

1985 RAPTOR RESEARCH FOUNDATION
SYMPOSIUM ON THE MANAGEMENT OF BIRDS OF PREY
INTERNATIONAL MEETING

Friday, November 8
Western North American Osprey Symposium



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* ABSTRACTS *

SESSION 9.

WESTERN NORTH AMERICAN OSPREY SYMPOSIUM

November 8, 1985
Sacramento, California

Hosted by:

The International Osprey Foundation

Held in conjunction with the 1985 Raptor Research Foundation Symposium
on the Management of Birds of Prey, International Meeting

Sponsored by:

Bureau of Land Management
California Department of Fish and Game
California Energy Commission
Hawk Mountain Sanctuary Association
Institute for Wildlife Studies
The National Audubon Society
Pacific Gas and Electric Company
The Peregrine Fund, Inc.
Southern California Edison Company
San Francisco Zoological Society
U.S. Fish and Wildlife Service
The Western Foundation of Vertebrate Zoology

Status of the Osprey in the National Forests of California.

DANIEL A. AIROLA (U.S.D.A. Forest Service, Box 767, Chester, California 96020. Phone: 916-258-2141).

The Osprey was designated "sensitive" by the U.S. Forest Service in the 1970's based on its need for management emphasis. Since then, effort has been made to monitor status and to protect and enhance habitat, especially at four population centers: the Klamath-Trinity River system, Shasta Lake, Eagle Lake, and Lake Almanor. Monitoring has emphasized determination of reproductive success (number of young fledged/occupied nest). At Klamath-Trinity reproduction has fluctuated widely, but has apparently remained high enough overall to maintain the population. At Shasta Lake reproduction was very low, and the population declined during 1974-1978, but reproduction and population size have since increased. At Eagle Lake reproduction has been adequate with a slight increase since 1969. At Lake Almanor the population has nearly doubled, and reproductive rate has increased markedly since 1969. Management has emphasized protection from disturbance, development of silvicultural prescriptions to retain and recruit nest sites, and construction of nest platforms. In recognition of the improvement in status and quality of management the Osprey was removed from the U.S. Forest Service's "sensitive" list in 1983.

Effect of habitat differences on prey delivery rates and reproductive success of Ospreys (Pandion haliaetus) in the Adirondack Mountains.

NANCY J. CLUM (Predatory Bird Research Group, Lower Quarry, University of California, Santa Cruz, California 95064. Phone: 408-429-2466).

Variation in the reproductive success of individual pairs of Ospreys has been observed both within and between different regions of the Adirondack Park. Poor reproductive success in this population is associated with low prey delivery rates. Placement of nests far from rivers results in foraging trips of longer duration, less food to the nest, smaller broods, and an increased probability of nest failure in years when ice break-up is late. During periods of open water, males forage within three miles of the nest site; thus the quality of lakes in the immediate vicinity of the nest is of great importance. Dissolved oxygen content, temperature, and pH were used to characterize lake quality. Temperature was positively correlated with duration of foraging trips, total time spent foraging, and total time spent away from the nest. Acidity is negatively correlated with brood size and the percentage of breeding attempts successful. Nests were classified as being in areas of high, moderate, or low human disturbance. Fewer nests are in high disturbance areas, but only nests in areas of moderate disturbance showed significantly lower reproductive success.

Monitoring the Osprey colony at Kent Lake, Marin County, California: five-year summary.

JULES EVENS (Point Reyes Bird Observatory, 4990 Shoreline Highway, Stinson Beach, California 94970. Phone: 415-663-1148).

A colony of 14 to 21 active nests along the shoreline of an impounded reservoir was monitored annually from 1981 through 1985. Results and parameters of the field work and historical constraints and ecological parameters are discussed.

The status of Osprey research in western North America.

CHARLES J. HENNY (U.S. Fish and Wildlife Service, Patuxent Wildlife Research Center, 480 S.W. Airport Road, Corvallis, Oregon 97333. Phone: 503-754-4840).

The status of research on the Osprey in western North America is reviewed. For discussion purposes the geographical populations are conveniently subdivided into Canada and Alaska, the Pacific Northwest of the United States, the western interior of the United States, and Mexico. Suggestions are made for further research on the populations in each region. In addition, possible research and management activities related to the extirpated or nearly extirpated California population on the Channel Islands and along the southern coast are presented.

Longevity of Osprey (Pandion haliaetus) nests in the Sonoran Desert, Mexico.

FRANCES HAMERSTROM and Frederick N. Hamerstrom (RR1, Box 448, Plainfield, Wisconsin 54966. Phone: 715-335-4100).

On a study area extending 29 km along the coast of the Gulf of California (and roughly 1-11 km wide) we have mapped about 100 Osprey nests and are studying their longevity. These nests are in columnar cacti, sahuasa (or cardon) (Pachycereus pringlei). This study started in 1973. A plethora of nest sites seems to exist, but only old sahuasas supply good substrates.

Ospreys (Pandion haliaetus) in Alaska: going to extremes.

JEFFREY H. HUGHES (Alaska Department of Fish and Game, 333 Raspberry Road, Anchorage, Alaska 99518-1509. Phone: 907-267-2201).

Information regarding the distribution and abundance of Ospreys in Alaska is sparse. In 1983 biologists with the Alaska Department of Fish and Game initiated an ongoing project to locate active, occupied, and inactive Osprey nests in interior Alaska; to assess the productivity of this species in Alaska; to band nestlings in accessible nest sites; and to determine pesticide contamination levels in addled eggs. Our efforts in interior Alaska to date include 29 young Ospreys banded, 1 band recovered, 3 eggs collected for pesticide analysis, and over 50 Osprey nests mapped and monitored for breeding activity. Osprey nesting habitat, including artificial nest structures and prey species utilized, is discussed.

Shell thickness and organochlorine pesticides in Osprey (Pandion haliaetus) eggs from Eagle Lake, California.

EDWARD E. LITRELL (California Department of Fish and Game, 1701 Nimbus Road, Suite F, Rancho Cordova, California 95670. Phone: 916-355-0136).

Addled Osprey eggs were collected at Pelican Point, Eagle Lake, California, during 1972-1979. Three additional eggs were collected in 1983, and five were taken in 1984. Chlorinated hydrocarbon residues and shell thicknesses were determined. Chlorinated hydrocarbons were detected in all egg contents, and some eggshells were thinner than normal. In 22 eggs examined pp'DDE was present up to 22 ppm wet-weight, and a maximum reduction of 16% in eggshell thickness was noted.

The Osprey in Central Europe.

BERND U. MEYBURG (World Working Group on Birds of Prey, Herbert-Str. 14, D-1000 Berlin 33, Fed. Rep. Germany. Phone: 4930-8254131).

The regular occurrence of the Osprey's breeding in Central Europe is today confined entirely to the North German/Polish lowlands. Within the present borders of Poland east of the Oder some 30-40 pairs still breed, almost exclusively in the lake districts of Masuria and Pomerania. Between 80 and 100 pairs still breed in the German Democratic Republic, around 45-50 pairs of them in the Mark Brandenburg and the remainder in Mecklenburg. A severe decline in Osprey numbers has been recorded on the Baltic coast following the World War II, where the species now breeds only sporadically. It formerly here reached its highest population density. On the other hand, the number of pairs at several places inland is increasing. For several years past, the breeding success of 15-20 pairs in an area with the highest breeding density has been monitored. The results will be compared with past records. All these pairs nest on high-tension pylons, as do about half of all pairs in other regions.

Nest site selection and habitat use by Ospreys in the Bitterroot Valley of western Montana.

PATRICK MULLEN (Montana Cooperative Wildlife Research Unit, University of Montana, Missoula, Montana 59812. Phone: 406-243-5372).

Nest site characteristics and prey species composition of Ospreys (Pandion haliaetus) nesting in the Bitterroot Valley were investigated during 1983 and 1984. River and pond nests differed in nest tree height, species, diameter at breast height, and stand density ($P < .001$). Differences were reflected in the fact that river nests were primarily in black cottonwood (Populus trichocarpa) (87%) while pond nests were primarily in ponderosa pines (Pinus ponderosa) (90%). River Ospreys fished for longer periods of time ($P < .05$), fished fewer times per day ($P < .05$), and delivered larger fish ($P < .005$) than pond Osprey. River Ospreys fed upon salmonids, cyprinids, and catostomids; pond Ospreys utilized percids and centrarchids ($P < .001$). Differences between habitats reflected the availability of nest trees and prey rather than selectivity by the Ospreys.

Migratory patterns and wintering locations of four U.S. Osprey populations: a comparative analysis of band recoveries.

ALAN POOLE (Boston University Marine Program, Marine Biology Laboratory, Woods Hole, Massachusetts 02543. Phone: 617-548-3705).

Banding recoveries ($N = 1,034$) and returns ($N = 115$) were analyzed to determine age and population differences in the migration patterns and wintering locations of U.S. Ospreys breeding north of 35°N . During fall migration (August - November), adult Ospreys from mid-Atlantic states are generally south of adults from more northerly regions. Juveniles from northeastern, but not mid-Atlantic, states lag behind breeding adults. Despite widely scattered recoveries, Ospreys from eastern, midwestern, and western populations follow roughly separate and parallel routes south from nesting regions, with similar longitudinal separation found on the wintering grounds. Most U.S. Ospreys winter in interior portions of northern South America and in southern Central America, between 0° - 15°N , although

some birds were recovered well south of the equator and in the United States. We found no significant latitudinal differences in wintering locations due to age or region of origin, however. During spring migration (March - May), Ospreys of breeding age (3+ years) from different East Coast colonies move south at similar rates, so northern birds arrive at nests later than southern birds. Midwestern Ospreys and two-year-old eastern Ospreys lagged behind adults from eastern colonies in spring; one-year-old Ospreys showed no movement away from wintering grounds during these months. Analysis of recovery records indicates significant age differences in the timing of peak mortality for Ospreys; most juveniles (< 1 year) die during fall migration, while most adults (2+ years) die in April and May, after arrival at breeding sites. Shooting has caused most reported deaths of Ospreys, with an increasing proportion of shot recoveries coming from Latin American countries in the past decade.

Recovery and current status of the Osprey in Michigan.

SERGEJ POSTUPALSKY (Department of Wildlife Ecology, University of Wisconsin, Madison, Wisconsin 53706. Phone: 608-221-8228).

Michigan's Osprey population has been monitored for more than two decades. During the early 1960's Osprey reproduction was severely impaired, a consequence of the thin-eggshell syndrome associated with DDE and possibly other toxic pollutants in the Osprey's food chain. Following a low during 1964-66 (0.2-0.4 young/occupied nest) productivity reached "normal" (i.e., estimated population maintenance) levels in 1971 and continues at or above such levels since then (0.9-1.5 young/occupied nest). The population was declining during the 1960's, remained more or less stationary during 1970-76 (75-85 pairs), and has been increasing since then. In 1985, 144 nesting pairs were located. Current research and management efforts, distribution patterns, and population dynamics are discussed.

Pennsylvania hacked three-year-old male Ospreys (Pandion haliaetus) nest and foster fledglings.

Larry M. Rymon and BRUCE FORTMAN (Department of Biology, Stroudsburg University, East Stroudsburg, Pennsylvania 18301. Phone: 717-424-3724).

A total of 105 Ospreys have been hacked in Pennsylvania since 1980. Three males from 1982 releases returned in 1985 and built nests. Two of these fostered 1985 releases shortly after fledging. Up to eight fledglings were fed by one male on a newly erected nest pole adjacent to the hack site. These activities and other postfledging behavior are very encouraging regarding the success of hacking as an Osprey management technique. The results of this six-year study have shown that Ospreys return with great fidelity to hacking locations. Furthermore, it appears hacking is a viable means of Osprey restoration on the global scale.

Osprey management along the Umpqua River, Oregon.

JOSEPH W. WITT (U.S. Bureau of Land Management, Roseburg District Office, 777 N.W. Garden Valley Blvd., Oregon 97470. Phone: 503-672-4491).

The Osprey nesting population along the Umpqua River between Roseburg and Scottsburg, Oregon, has increased by 50% during the 1981-1985 nesting seasons. Management activities on BLM-administered lands during the same interval consisted of installing 16 nesting platforms and creating 5 accessory perches within 13 potential and/or existing occupied territories. Active platform nests were established within 8 of the 13 sites accounting for 50% of the total population increase. Fledgling surveys utilizing either a ground survey technique (1981 and 1984) or a helicopter survey technique (1982, 1983, and 1985) revealed an average productivity of 1.22 (range: 0.89-1.86) fledglings/occupied territory and 1.41 (range: 1.00-1.93) fledglings/active nest.



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1985 RAPTOR RESEARCH FOUNDATION

SYMPOSIUM ON THE MANAGEMENT OF BIRDS OF PREY

INTERNATIONAL MEETING

Saturday, November 9 and Sunday, November 10
Second Raptor Research Foundation Conference
on Raptor Conservation Techniques



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Causes of Bald Eagle nesting failures to recovery goals.
ROBERT S. ANTHONY, Richard J. and Frank B. Isaacs (Oregon
Cooperative Wildlife Research Unit, Department of Fisheries & Wildlife,
Oregon State University, Corvallis, Oregon 97331. Phone: 503-754-4911).

Over the years, raptor biologists have routinely surveyed breeding
success and productivity of populations in an attempt to assess the status
of various species. These surveys usually identified nesting fail-
ures, but rarely have the causes of nesting failures been assessed. From
1979 to 1983, we studied the causes of nesting failures of Bald Eagles in
Oregon by either direct observation or by searching for evidence of failures
from which young were not produced. Evidence of failures included lack of
presence or absence of intact eggs, eggshell fragments, prey remains, and
carcasses of young were used to assess the causes of failures. Implicated
causes of failures included pesticides, proximity of neighboring breeding
pairs, changes in water, infertile eggs, pre-fledgling mortality, human
disturbance, lack of an adequate food supply, severe weather. We also
assessed the effects of human activities such as logging to nests to band
young. Various case histories are discussed, and the results are evaluated
relative to setting recovery goals for the species.

SESSION 10.

SECOND RAPTOR RESEARCH FOUNDATION CONFERENCE ON RAPTOR CONSERVATION TECHNIQUES

November 9-10, 1985
Sacramento, California

Hosted by:

Collisions of Cape Vultures (*Uruba capensis*) with towers.

PATRICK C. JONSON, Raptor Research Foundation, Inc., Zoology, University
of Witwatersrand, Johannesburg, 2001, Republic of South Africa. Phone:
0151792 (home 1121).

Avian mortalities due to man-made objects have been reported since 1878
with communication towers being a main target. Upon initial search of the
tower-base at the Kromberg vulture colony in South Africa, 29 carcasses
were found. All but six were being directly under the guy-wires or within
10 m of the tower base. Most of the carcasses were not decomposed to determine
the cause of death.

Held in conjunction with the 1985 Raptor Research Foundation Symposium
on the Management of Birds of Prey, International Meeting
collisions on the Management of Birds of Prey, International Meeting
dense fog that often shrouds the mountain during the breeding season.
However, in 1981 some of the 13 collisions of newly fledged Cape Vultures
occurred during clear daylight hours. In 1984 the South Africa Broad-
casting Corporation designed and attached orange spheres to the guy-wires
to warn the vultures. During the following fledgling season collisions
decreased; however, it will be necessary to continue monitoring the tower
to evaluate the spheres' effectiveness.

Sponsored by:

Bureau of Land Management
California Department of Fish and Game
DAVID M. KING (Chairman) California Energy Commission
21,111 Lakeshore Blvd. Hawk Mountain Sanctuary Association 100. Phone: 514-
457-2000).
Institute for Wildlife Studies
The National Audubon Society
Forcing captive for double clutch, i.e., forced
nesting or "double clutch" production has been
readily adopted by most raptor breeders. In a study of 78 pairs
of captive American Bald Eagles from 1974 to 1977, replacement
clutches were laid in 1974, 1975, and 1976, and eggs with
thicker shells than those of the first clutch. Fledgling
success, and ultimate survival of the young were also studied. A study of
The Peregrine Fund, Inc.
Southern California Edison Company
San Francisco Zoological Society
U.S. Fish and Wildlife Service
The Western Foundation of Vertebrate Zoology

Causes of Bald Eagle nesting failures: implications to recovery goals.

ROBERT G. ANTHONY, Richard W. Frenzel, and Frank B. Isaacs (Oregon Cooperative Wildlife Research Unit, Department of Fisheries & Wildlife, Oregon State University, Corvallis, Oregon 97331. Phone: 503-754-4531).

Over the years, raptor biologists have routinely surveyed breeding success and productivity of populations in an attempt to assess the status of various species. These surveys have usually identified nesting failures, but rarely have the causes of nesting failures been assessed. From 1979 to 1983, we studied the causes of nesting failures of Bald Eagles in Oregon by climbing 71 active nests (adults in incubating posture observed) from which young were not produced. Condition of the nest platforms and presence or absence of intact eggs, eggshell fragments, prey remains, and carcasses of young were used to assess the causes of failures. Implicated causes of failures included pesticides, proximity of neighboring breeding pairs, changes in mates, infertile eggs, pre-fledgling mortality, human disturbance, lack of an egg being laid, and severe weather. We also assessed the effects of capturing adults and climbing to nests to band young. Various case histories are discussed, and the results are evaluated relative to setting recovery goals for the species.

Collisions of Cape Vultures (Gyps Coprotheres) with towers.

PATRICK C. BENSON and Joan C. Dobbs (Department of Zoology, University of Witwatersrand, Johannesburg, 2001, Republic of South Africa. Phone: 0152792 Bochum 1121).

Avian mortalities due to man-made objects have been reported since 1876 with communication towers being a main target. Upon initial search of the tower-base at the Kransberg vulture colony in South Africa, 49 carcasses were found. All but six were lying directly under the guy-wires or within 10 m either side. Most of the carcasses were too decomposed to determine age. From mapping out the carcasses we found a directional bias in their collision sites. Causes of the collisions were thought to be due to the dense fog that often engulfs the mountain during the breeding season. However, in 1983 some of the 12 collisions of newly fledged Cape Vultures occurred during clear daylight hours. In 1984 the South Africa Broadcasting Corporation designed and attached orange spheres to the guy-wires to warn the vultures. During the following fledging season collisions decreased; however, it will be necessary to continue monitoring the tower to evaluate the spheres' effectiveness.

Forced renesting in birds of prey: a review.

DAVID M. BIRD (Macdonald Raptor Research Centre of McGill University, 21,111 Lakeshore Rd., Ste. Anne de Bellevue, Quebec H9X 1C0. Phone: 514-457-2000).

Forcing captive falcons to lay a replacement clutch, i.e., forced renesting or "double-clutching," to augment seasonal production has been readily adopted by most captive breeding programs. In a study of 78 pairs of captive American Kestrels (Falco sparverius) from 1974 to 1977, replacement clutches were shown to have fewer eggs, longer eggs, and eggs with thicker shells than first clutches. Fertility, hatchability, fledging success, and ultimate size of young did not differ, however. A study of

11 wild kestrel pairs during 1982-1983 resulted in 82% of the pairs laying replacement clutches. There were no significant differences in egg dimensions, fertility, or hatchability between the control pairs and those forced to renest. First clutch progeny fledged significantly younger than second clutch birds. Of three pairs of Peregrine Falcons (F. peregrinus) double-clutched at Ungava Bay in 1984, two failed to renest (one was not checked).

Urban Peregrines: good news and bad news.

DAVID M. BIRD (Macdonald Raptor Research Centre of McGill University, 21,111 Lakeshore Rd., Ste. Anne de Bellevue, Quebec H9X 1C0, Canada).

Historically, Peregrine Falcons have taken to nesting in cities, e.g., Montreal's famous Sun Life pair, the New York City pair, etc. With the advent of captive breeding programs and subsequent releases of Peregrines into urban/suburban environments, a number of pairs have established themselves on skyscrapers and bridges in several prominent North American and European cities. In 1985 Baltimore, New York City, Los Angeles, Edmonton, Calgary, and Montreal are well-known examples. Ample abundance of ledges on artificial structures (enhanced by provision of nesting trays), as well as prolific populations of pigeons, Starlings, and other city-dwelling species have led to increased Peregrine use of cities. However, hidden dangers are present to both adult and young falcons; including excessive disturbance by building maintenance operations, poison-control programs for pigeons, increased collision risk, and grounding during fledging.

The pit trap: its effectiveness on cathartid vultures and eagles.

PETER H. BLOOM, Steven B. Kimple, and Gregory D. Sanders (Condor Research Center, 2291-A Portola Road, Ventura, California 93003. Phone: 805-644-1766), Lawrence Riopelle (Ecosystems Research Unit, National Audubon Society, Route 6, Box 1877, Naples, Florida 33964. Phone: 813-657-2532), and Michael P. Wallace (Los Angeles Zoo, 5333 Zoo Drive, Los Angeles, California 90027. Phone: 213-666-4650 ext. 256).

A pit trap for use on California Condors (Gymnogyps californianus) was designed and tested. Before using it on California Condors, we first tested it for safety and effectiveness on Andean Condors (Vultur gryphus) in Peru and Golden Eagles (Aquila chrysaetos) in California. This almost forgotten technique has proven to be one of the safest and perhaps most effective traps available to researchers of large carrion-eating raptors. It also functions as a superb blind. One Andean Condor, two California Condors, and twenty-five Golden Eagles have been captured. Testing on other species, including the Turkey Vulture (Cathartes aura) and Bald Eagle (Haliaeetus leucocephalus), is in progress.

Management of Gyrfalcons in the Northwest Territories, Canada.

ROBERT G. BROMLEY (Department of Renewable Resources, Government of the Northwest Territories, Yellowknife, Northwest Territories, Canada X1A 2L9. Phone: 403-873-7077).

Management of Gyrfalcons in the Northwest Territories began in 1981, when an experimental quota of 50 falcons for commercial sale was established. In 1982 the annual quota was reduced to 20 passage juveniles. To date only four birds have been harvested. Regulations were designed to ensure that financial benefits accrue to resident Inuit who rely largely on renewable resources for both material and economic provisions. Aerial and ground surveys of nesting Gyrfalcons have been conducted in the central and eastern Arctic regions. Results indicate that the numerical status and productivity are stable. If and when increased exploitation of the resource is desired, additional studies investigating the existence of surplus adults and the ultimate effect of removal of passage juveniles on the breeding adult population would be required. At the 1985 CITES meeting, Gyrfalcons were reassigned to Appendix I, restricting international trade of the species. Canada strongly disagrees with this action and is presently considering various options that would permit trade with nonsignatory nations to continue.

Relationship between Bald Eagle distribution and shoreline development on the northern Chesapeake Bay.

DAVID A. BUEHLER and James D. Fraser (Department of Fisheries and Wildlife, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061. Phone: 703-961-6064), and Janis Chase (Chemical Research and Development Command, Aberdeen Proving Ground, Maryland 21010. Phone: 301-671-3868).

Bald Eagle aerial shoreline surveys were conducted monthly on the northern Chesapeake Bay from January 1984 through June 1985. The distribution of distances from 530 Bald Eagle locations to the nearest human development site was compared with the distribution of distances from 349 random points to the nearest human development site. Eagles selected areas further away from human development ($\bar{x} = 1287$ m) than points selected at random ($\bar{x} = 762$ m) ($p > 0.05$). Mean distances from eagles to developed areas on the well developed, eastern shore of the Bay were significantly less than those on the western shore, an area comprised primarily of undeveloped Army property ($p > 0.05$). Although shoreline development itself may not repel Bald Eagles, we believe it is a good index to human disturbance which can affect eagle distribution. Continued shoreline development (and human disturbance) on the Chesapeake may further reduce potential habitat for Bald Eagles.

Human impacts associated with and the use of timelapse photography for recording Bald Eagle food habits and nesting activities.

STEVEN L. CAIN (U.S. Fish and Wildlife Service, P.O. Box 1287, Juneau, Alaska 99802. Phone: 907-586-7243).

Timelapse photography data recording units were placed at 13 active Bald Eagle (Haliaeetus leucocephalus) nests from 1982-1984 in southeast Alaska. Effects of monitoring activities on individual nesting pairs ranged from nest abandonment to little or no effect. Stage of the nesting

cycle, proximity of the camera to the nest, and previous association with humans affected the eagles' reactions to monitoring activities. Timelapse films recorded detailed nesting activity time budgets, food habits, nestling feeding rates, and prey delivery rates.

Management of human impacts on active Bald Eagle nests based on nesting activity time budgets.

STEVEN L. CAIN and John I. Hodges (U.S. Fish and Wildlife Service, P.O. Box 1287, Juneau, Alaska 99802. Phone: 907-586-7243).

Dense Bald Eagle (Haliaeetus leucocephalus) nesting and increased coastal development in southeast Alaska have made potential human disturbances near active nests commonplace. A single disturbance management strategy for all nests is impractical due to the variable reactions of individual pairs to disturbance. The U.S. Fish and Wildlife Service in Alaska recommends continual monitoring of active Bald Eagle nests where potentially disturbing human activities occur. Recommendations on whether these activities should continue, be rescheduled, or halted are based on divergences in the affected pair's behavior from that considered normal in undisturbed conditions. Data from recently completed research on the nesting activity time budgets of Bald Eagles in Alaska could be used as a basis for comparisons with nesting time budgets observed in disturbed areas.

Oil Contamination on migrating raptors.

WILLIAM S. CLARK (9306 Arlington Blvd., Fairfax, Virginia 22030. Phone: 703-591-7778), and Edna Gorney (Society for the Protection of Nature in Israel, 4 Hashfela St., Tel-Aviv, 66183 Israel. Phone: 3-335063).

There are few accounts of oil contamination of raptors, and it has not been considered a threat to them. However, we and our colleagues found oil-based asphalt on 40 individuals of 7 species out of 606 raptors (6.6%) captured and examined in the spring of 1985 during our raptor migration study at Elat, Israel. No contamination was noted on 81 individuals of 11 other raptor species. The birds most likely picked up the contamination while drinking water from pools with surface oil. Examples of the contamination will be shown. Over 1.2 million raptors were counted passing Elat during the spring of 1985. If 6.6% of these were contaminated, that would be over 80,000 birds. Thus, asphalt contamination would appear to be more than a minor problem for migrating raptors in the Old World.

Impact of a high-voltage transmission line on a nesting pair of Bald Eagles in southeast Louisiana.

DAVID A. DELL (School of Forestry, Wildlife, and Fisheries, Louisiana State University Agricultural Center, Baton Rouge, Louisiana 70803. Phone: 504-388-4131), and Phillip J. Zwank (Louisiana Cooperative Wildlife Research Unit, School of Forestry, Wildlife, and Fisheries, Louisiana State University, Baton Rouge, Louisiana 70803. Phone: 504-389-0404).

To evaluate the impact of a 500-kV power transmission line on a pair of nesting Bald Eagles, pre- and post-installation observations of eagle area-use were recorded. The average daily proportion of eagle-minutes

spent in the vicinity of the power line decreased ($F = 5.7$, $P = 0.02$) from pre-installation ($\bar{x} = 27.6\%$) to post-installation ($\bar{x} = 18.7\%$) seasons, but was possibly due to the observer's presence near a favored hunting perch. No biologically significant impact of the power line could be ascertained. The eagles regularly flew over and under the power line and perched and foraged near it. They never used the power line itself for perching.

Raptors and Man--a century of change in the Scottish Highlands.

ROY H. DENNIS (Royal Society for the Protection of Birds, Highland Office, Munlochy, Ross & Cromarty, Scotland IV8 8ND. Phone: 046-381-496).

The Nineteenth Century witnessed a massive slaughter of raptors in the United Kingdom. Even in remote mountain regions like the Scottish Highlands the Victorian sportsmen shot, trapped, and poisoned vast numbers. Populations slumped, and four species (including the White-tailed Sea Eagle) became extinct. The latter part of this century has heralded a change of heart towards raptors, while recent decades have seen increasing public interest, especially through T.V., radio, newspapers, and books. In Scotland outstanding public interest has been aroused by "Operation Osprey," a unique public viewing facility set up by the RSPB in 1959 when Ospreys returned after 50 years to breed in Scotland. Every spring "Operation Osprey" has guarded the pair of breeding Ospreys and encouraged visitors; in May 1983 the millionth visitor walked up the small woodland path to the observation post. The 60,000 Osprey visitors per annum are not necessarily nature lovers; importantly, they represent the widest spectrum of the general public. At the same time the RSPB has built up a network of monitoring schemes for birds of prey in the Highlands, including rewards for successful eagle nests. Now the thrust is toward personal involvement and cooperation in monitoring and safeguarding sites between the RSPB and landowners, foresters, and hunters. Newsletters and raptor information are mailed to these contacts who in return are encouraged to gather data for our files. Additionally, a stronger line is taken with inveterate law-breakers, and this has involved public campaigns including a very successful anti-poison campaign in 1980 which involved the distribution of large quantities of leaflets, including a version in Gaelic for native speaking areas of the Highlands and Islands. At the present time raptor populations have responded very well to decreased persecution and are now at their highest levels in a century. Future publicity on raptors will focus on the need for their protection as an accepted part of the ecosystem, public interest, and tourism value, as well as on their role as indicators of the quality of the environment.

A review of artificial nesting structures for Bald Eagles in California.

PHILLIP J. DETRICH and Robert N. Lehman (U.S. Bureau of Land Management, 555 Leslie St., Ukiah, California 95482. Phone: 701-462-3873).

Since 1978, biologists have installed a variety of artificial nest supports in eleven Bald Eagle (Haliaeetus leucocephalus) breeding territories (15% of the State's total) in northern California. At four territories climbers added supports and partially reconstructed nests which had collapsed; Bald Eagles subsequently used all of these nests. In nine

nesting territories artificial nest structures were placed in 28 trees which held no nests previously; only two of these were used (both in the same territory.) In three cases Bald Eagles disregarded artificial structures and built new nests in unmodified trees. A nest support designed for Osprey was used instead by Bald Eagles, but was abandoned after a single reproductive effort. In attempts to encourage Bald Eagles to colonize unoccupied areas, 14 structures were installed at three lakes within 50 km of occupied areas; none were used by Bald Eagles in the one to three years since installation. Costs averaged about \$300 per structure, but ranged as low as \$50. In general, these data suggest that artificial nest supports 1) are more likely to be used in formerly used nest trees which have become unsuitable, or where replacement trees of appropriate size and structure are lacking in an occupied territory; 2) are less likely to be used when suitable, unmodified trees are available; and 3) should not be expected to attract eagles into unoccupied habitats. Further, our review indicates that nest supports 1) should not be used with the specific intent of modifying eagle behavior or habitat use in unsuitable areas; 2) should be used only when a compelling management need is perceived, or under special or unusual circumstances; and 3) should be used only after expert site evaluations confirm that long-range management potential exists. In many cases management dollars could more appropriately be directed to silvicultural improvements. Maintenance and monitoring of structures, further research needs, management priorities, and site-evaluation factors are identified.

The necessity of three- to five-year biological studies for effective species management.

JOAN C. DOBBS and Patrick C. Benson (Department of Zoology, University of Witwatersrand, Johannesburg, 2001, Republic of South Africa. Phone: 0152792 Bochum 1121).

Effective species management assumes that both the basic biology of a species, as well as which factors are significantly affecting its survival, are known. The data from three years of intensive study conducted on the Cape Vulture (Gyps coprotheres) are used to show the potential for management decision-making errors when data from each year are independently analyzed from other years. Eight factors impacting the Cape Vulture were identified at the Kransberg colony, including strychnine poisoning, recreational climbing, baboon and Black Eagle predation, guy wire and barbed-wire fence collisions, and veld fires. However, the individual factors negatively impacting reproductive success not only varied from year to year, but also varied in their importance ranging from a single observed occurrence to a potential threat to the population. When theoretical management recommendations are based on any one year of study, both recommendations and emphasis change drastically.

When the raptor biologist is called to court!

THOMAS C. DUNSTAN (Department of Biological Sciences, Western Illinois University, Macomb, Illinois 61455. Phone: 309-298-1546).

As raptorial birds acquired a new image in the eyes of the public during the last two decades, so did their importance as research subjects, art forms, and new symbols of the public's conscience toward their environment.

Persons, specifically research biologists, with interests in birds of prey have in the past chosen professions that avoided the usual high profile arenas of the courts of the land. Today, some of these same people find themselves brought into situations entirely different from situations they originally desired in life. Scientists, both young and old, find themselves called to court as "expert witnesses" in behalf of raptorial birds and the litigation process. As individuals or as a group we must ask, are we prepared and up to the task?

Development of a management strategy document and application of management techniques for a Midwest Bald Eagle wintering system.

Thomas C. Dunstan, R.G. HARPER (Department of Biological Sciences, Western Illinois University, Macomb, Illinois 61455. Phone: 309-298-1546) and David L. Fisher (presently, Department of Zoology, Brigham Young University, Provo, Utah 84601).

As a result of the explosion of research studies about birds of prey during the last 25 years, the scientific community has developed numerous management techniques and strategies. Some techniques are species specific, and others are applicable to many species in many parts of the world. From 1966 to 1985 we have developed and/or applied techniques for enhancing winter ranges for Bald Eagles in Midwest America. A basic management strategy document was developed from information gathered along 600 miles of the Mississippi River and its tributaries from Minnesota to Kentucky. Applied management techniques included aerial and ground censuses, identification of four critical habitat components at each wintering site, habitat acquisition, litigation and mitigation, and various forms of habitat modification of areas used for night roosting, foraging, eating, and resting.

Sublethal effects of agricultural pesticides on raptors.

D. MICHAEL FRY and Gary M. Santolo (Department of Avian Sciences, University of California, Davis, California 95616. Phone: 916-752-1300).

Studies of pesticide effects on non-target mammals and birds have focused on the assessment of approximate lethal dose (LD_{50}), but studies of sublethal effects have not been required for pesticide licensing. Many compounds have significant nonlethal effects, the best documented being eggshell thinning by DDT metabolites, a side effect not related to the primary mode of pesticide action. Exposure to heavy metals impairs synthesis of brain cholinesterase and lowers the resistance of mammals and birds to carbamates or organophosphates. The metabolic inhibitor fluoroacetate damages cells of the cerebellum resulting in loss of cells in non-regenerating areas of the brain, possibly resulting in reduced ability of raptors to fly and forage. Exposure to granivorous birds may result in impaired capacity to avoid predators. Developmental anomalies caused by low levels of pesticides transferred to eggs or fed to chicks are manifested by behavioral modifications not easily quantified. Methods to evaluate subtle, sublethal nervous system damage include training animals to perform tasks before exposure followed by quantitative measurement of performance.

Telemetry of physiological parameters from raptors: a review.

JAMES A. GESSAMAN (Department of Biology, Utah State University, Logan, Utah 84322. Phone: 801-750-2568).

Body temperature has been telemetered from captive and free-ranging hawks and eagles for more than 20 years. Telemetered heart rate has indirectly monitored flight activity, level of sympathetic nerve stimulation, level of resting metabolism, and presence of an incubating bird on eggs. Telemetry of other physiological parameters has received much less attention.

A method for estimating proportion of area occupied.

PAUL H. GEISSLER and Mark R. Fuller (U.S. Fish and Wildlife Service, Patuxent Wildlife Research Center, Laurel, Maryland 20708. Phone: 301-498-0313 and 301-498-0282), and James A. Mosher (Savage River Consulting, P.O. Box 71, Frostburg, Maryland 21532. Phone: 301-689-2875).

Censuses or estimates of density for raptors are often difficult to accomplish because of constraints imposed by detecting such widely dispersed animals. However, the goal of many surveys is to determine the presence of individuals of a species on a study area or management unit. We developed a method to estimate the proportion of an area that is occupied by a species, based on detections of individuals from replicates along transects or at stations. One can determine the probability that an area was occupied despite not having detected a bird. Adjustments to the estimates can be made for differences in detectability due to species, habitat, season, etc. Thus, the probabilities of an area being occupied can be compared among species, study areas or years, and the results can be used to monitor long-term changes in occupancy.

Management strategies for a polygynous raptor: Circus cyaneus.

F. and F. HAMERSTROM (RR 1 Box 448, Plainfield, Wisconsin 54966). Polygyny, abetted by marked tendency for Harriers that have reared young successfully to return to the same area to breed in another season, gives stability to a Harrier management unit. When voles (Microtus spp.) are abundant, new cohorts of potential breeders are attracted. These potential breeders need space to establish themselves, so it would rarely pay to manage only enough land for onenesting pair.

Case histories of organophosphate pesticides killing birds of prey in the United States.

CHARLES J. HENNY, Elizabeth J. Kolbe, Elwood F. Hill, and Lawrence J. Blus (U.S. Fish and Wildlife Service, Patuxent Wildlife Research Center, 480 SW Airport Road, Corvallis, Oregon 97333. Phone: 503-757-4840).

Since 1982 when secondary poisoning of Red-tailed Hawks (Buteo jamaicensis) was documented following the recommended use of famphur on cattle, the Patuxent Wildlife Research Center has tested for organophosphate (OP) poisoning in selected birds of prey found dead. This report documents the circumstances for a number of cases where birds of

prey were killed by OP pesticides in the United States. Many of the cases were brought to our attention by the U.S. Fish and Wildlife Service Division of Law Enforcement. The cases may be divided into three categories: misuse, approved use, and unknown. Now that we are looking for OP poisoning of birds of prey, we are finding it more frequently than previously suspected.

Responses of breeding Prairie Falcons (Falco mexicanus) to experimental blasting.

A.M.A. HOLTHUIJZEN (Idaho Power Company, P.O. Box 70, Boise, Idaho 83707. Phone: 208-383-2729) and W.G. Eastland (U.S. Bureau of Land Management, 3948 Development Way, Boise, Idaho 83705).

Four pairs of Prairie Falcons breeding in the Owyhee foothills, southwestern Idaho, were subjected to experimental blasting. Air blasts were made at each scrape three times per day, every other day, from the onset of incubation until chicks were at least 35 days old. Each blast consisted of the equivalent of one stick of dynamite detonated 120-140 m from the scrape. Falcon behavior was observed from 30 minutes prior to each blast until 30 minutes after the blast. Behavior of each pair was also observed from 30 minutes before sunrise until 30 minutes after sunset once every six days throughout the breeding season. Initially, falcons reacted strongly to blasts; however, the nature and intensity of their responses rapidly diminished, suggesting habituation. Overall behavior of the experimental pairs did not appear to differ significantly from that of a control sample of four falcon pairs breeding in the nearby Snake River Canyon. All experimental pairs successfully raised chicks, and productivity of experimental pairs (\bar{x} = 3.25 chicks/pair) was similar to that of control pairs (\bar{x} = 3.5 chicks/pair).

Northward migration of postfledgling Bald Eagles from California, an added dimension to managing the Pacific States population.

W. GRAINGER HUNT (BioSystems Analysis, Inc., 303 Potrero, Suite 29-203, Santa Cruz, California 95060. Phone: 408-425-8755), Ronald E. Jackman (BSAI), Mark A. Jenkins (Department of Engineering Research, Pacific Gas and Electric Company, 3400 Crow Canyon Road, San Ramon, California 94583. Phone: 415-820-2000), Robert N. Lehman (BSAI), and Carl G. Thelander (BSAI).

Three Bald Eagles telemetered as nestlings along the Pit River in Northern California made direct flights northward into Canada. We believe that these migrations are related to late summer salmon spawns, the timing of which coincides with the eagles' arrival in northwestern Canada and Alaska. These observations suggest a need for a broader, integrated management approach for Pacific States Bald Eagles. It is now clear that individual subadult birds may fledge from a nest area in California and then use late summer feeding areas in Canada and Alaska, migration corridors in between, and (presumably) wintering areas back in California--all in the same seven- to nine-month period.

Age, breeding, turnover, and dispersal in urban Merlins (Falco columbarius).

PAUL C. JAMES (Veterinary Anatomy Department, University of Saskatchewan, Saskatoon, Saskatchewan, Canada, S7N 0W0. Phone: 306-966-7414).

Interest has recently emerged in introducing Merlins into North American urban centers. Some preliminary data are therefore given on the age structure, breeding, turnover, and dispersal of a self-introduced Merlin population in Saskatoon, Canada. Seventy-two percent of breeders were three years of age or less, and the oldest birds were six. Mean age of first breeding was 2 for males and 1.5 for females. Pairs with a yearling produced fewer chicks (3.1) than pairs without (4.1). Turnover on territories was 64% for females and 27% for males per year. Allowing for movements, a maximum annual mortality rate of 22% was calculated. This compares with a rate of 43% calculated from banding recoveries. Breeding dispersal was less than natal dispersal. Unlike other raptors, no evidence existed for differential natal dispersal between the sexes, expressed either as distance moved or as the proportion of breeders banded locally as chicks.

Foraging ecology of Bald Eagles on a regulated river.

J. MARK JENKINS (Department of Engineering Research, Pacific Gas and Electric Company, 3400 Crow Canyon Road, San Ramon, California 94583. Phone: 415-820-2000), W. Grainger Hunt, Ronald E. Jackman, and Carl G. Thelander (BioSystems Analysis, Inc., 303 Potrero Street, Suite 29-301, Santa Cruz, California 95060. Phone: 408-425-8755).

During 1983 and 1984 we studied the abundance, distribution, and foraging ecology of resident and migrant Bald Eagles along the Pit River in Northern California. Winter flows sometimes exceed 10,000 cubic feet per second (cfs) in marked contrast to summer flows, which are regulated and range from 30-150 cfs. These regulated reaches are used extensively by resident Bald Eagles foraging on fish, primarily Sacramento sucker (Catostomus occidentalis) and hardhead (Mylopharodon conocephalus). Bald Eagles used pool habitat almost exclusively in the river reaches for foraging, yet pools constitute only about 30% of the available riverine habitats. In summer 1984 we quantified Bald Eagle foraging habitat (pools) under four different flow regimes (50, 100, 150, 300 cfs), recording such physical data as surface turbulence, surface velocities, depth, temperature, turbidity, substrates, and other factors for selected pools at each flow. Pools were mapped at each flow, and the biotic features of the pool, such as algal growth and fish abundance, also were recorded. Blinds were constructed and manned at known eagle-use pools, and a number of observations of eagles foraging at these pools were recorded. Pools used most frequently by foraging Bald Eagles were those with large shallow areas of no surface turbulence. Our goal was to predict the relative availability of Bald Eagle foraging habitat under a variety of flow regimes. This approach has direct management application in allowing determination of flow regimes that maximize the availability of Bald Eagle foraging habitat in the Pit River. A complete report of study results is available from the first author.

A study of observer efficiency during 1984 autumn raptor migration at Cape May Point, New Jersey.

RENÉ KOCHENBERGER (Cape May Bird Observatory, P.O. Box 3, Cape May Point, New Jersey 08212. Phone: 609-884-2736).

During peak raptor migration dates the efficiency of the Official Hawkwatcher was evaluated using a variety of methods originally developed by Sattler and Bart and used at Derby Hill, New York. The question addressed was: "What proportion of the visible birds does the Official Counter actually detect?" Data were collected on observer efficiency for accipiters, falcons, and total raptors. The effects of factors, such as daily flight size and observer fatigue due to eyestrain, on a counter's efficiency were also tested. By comparing data on individual Peregrine Falcon sightings, observer efficiency could be tabulated in this manner and compared to the overall results as a control. In general, results duplicated those of Sattler and Bart at Derby Hill. The results are important in our continual quest for making data from official hawk-watch sites more meaningful when attempting to evaluate the population dynamics of various raptor species for conservation/management techniques.

Electrophoretic identification of raptor pellets.

MONICA G. LECLERC (U.S. Army Dugway Proving Ground, Mail Stop MT-L-E, Dugway, Utah 84022. Phone: 801-831-5476).

SDS--polyacrylamide gel electrophoresis was tested as a method for identifying raptor pellets by species. Successful discrimination was obtained for several species of buteo, falcon, owl, and eagle. Each species tested produced a unique protein pattern. Diet of captive birds was controlled to test for effects of prey content on protein patterns. Gels from each species were catalogued as references for comparison to gels from unknown pellets. Use of this technique did not damage pellet contents thus permitting food habits analysis for birds of prey outside the breeding season.

Management planning for a Bald Eagle winter roost on public lands in California.

ROBERT N. LEHMAN (U.S. Bureau of Land Management, Alturas Resource Area, Centerville Road, P.O. Box 771, Alturas, California 96101. Phone: 916-233-4666).

Up to 250 Bald Eagles (Haliaeetus leucocephalus) have been recorded in a communal winter roost on Bureau-administered lands in the Klamath Basin of northeastern California. A relict stand of ponderosa pine (Pinus ponderosa) near the summit of Mt. Dome, Siskiyou County, is also the site of an occupied Bald Eagle breeding territory. During a 1984 assessment of short- and long-range management needs on Mt. Dome, it was determined that 1) the mountain's isolated location and difficult terrain, in part, have resulted in almost negligible public use levels, 2) intensively managed Federal waterfowl refuges nearby provide a stable, relatively uncontaminated food source, and 3) timber on Mt. Dome is not on BLM's allowable cut base. Yet, serious threats to Bald Eagle habitat on Mt. Dome do exist. Dense, steep brush fields flank the roost stand on all sides; dense thickets of white fir have developed within the stand, under

the canopy; and general stand decadence has contributed to deep accumulations of dead and down materials, litter, and other ground-based fuels. Timber on Mt. Dome, conceivably, could be lost or severely reduced during a single, catastrophic wildfire. If loss to fire does not occur, and if current trends are not reversed through silvicultural intervention, the preferred ponderosa pine community will stagnate and in time be replaced by succession of white fir and other competing vegetation. Between 1984 and 1985 the Bureau developed a comprehensive habitat management plan identifying the actions and constraints necessary to reclaim site quality and secure Bald Eagle habitat. Implementation of planned actions will reduce fire hazards, streamline fire suppression operations, improve timber stand structure, ensure overstory recruitment of pines, and maintain disturbance-free conditions. Accomplishment of all objectives will allow the eventual return of fire to Mt. Dome--a native ecosystem process--and the development of a cost-effective, fire-climax management regime, based on the integration of silvicultural and fire-management systems.

Investigations by the California Department of Fish and Game of raptor mortalities due to pesticides.

EDWARD E. LITTRELL (California Department of Fish and Game, 1701 Nimbus Road, Suite F, Rancho Cordova, California 95670. Phone: 916-355-0136).

The California Department of Fish and Game (CDFG) works with other government and public interests to prevent or rectify pesticide impacts. Administrative mechanisms are available to modify use practices or labeling, if necessary, to prevent losses in cases of demonstrated hazardous pesticides. Materials which are most likely to affect raptors include the organophosphate insecticides, chlorinated hydrocarbons, strychnine, and anticoagulants. The effects of anticoagulants have been demonstrated in the laboratory but not in the field. Sodium monofluoroacetate (Compound 1080), a rodenticide and predicide, is being examined by the University of California under contract to CDFG. We can determine by necropsy and chemical analysis if mortality was due to pesticides. Samples are accepted from the public if prior arrangements are made.

Restoring breeding populations of the southern Bald Eagle (Haliaeetus leucocephalus leucocephalus--1st year progress report.

GWYN MCKEE, Steve K. Sherrod, and M. Alan Jenkins (George Miksch Sutton Avian Research Center, P.O. Box 2007, Bartlesville, Oklahoma 74005. Phone: 918-336-7778).

To test the feasibility of recycling wild pairs as a method of producing eagles for restoration projects and as a first step in restoring breeding populations of the southern Bald Eagle, whole clutches were taken from nine nests in the Gainesville-Ocala, Florida, area late in 1984. All pairs of donor eagles re-laid and fledged young at a rate equal to controls. Specialized equipment and methods were developed for protecting and handling developing eggs which were transported to Oklahoma. Seventeen of eighteen eggs were hatched after incubation by bantam hens and modified commercial incubators. Techniques to prevent imprinting and siblicide in totally hand-reared eagles were developed. Four chicks died, probably

from a vitamin B₁ deficiency caused by a diet of mostly fresh-frozen fish. This may be an unrecognized problem with the long-term nutrition and captive care of this and other fish-eating species. The remaining eagles were hacked in Oklahoma, Georgia, and Alabama.

Cooper's hawk nesting habitat use and selection in eastern N. America.

JAMES A. MOSHER (Savage River Consulting, P.O. Box 71, Frostburg, Maryland 21532. Phone: 301-689-2875), Kimberly Titus (Department of Wildlife Biology, Virginia Polytechnic Institute, Blacksburg, Virginia 24061. Phone: 703-961-5046), Robert N. Rosenfield (Rt. 1, Box 82, Amherst, Wisconsin 54406. Phone: 715-824-3114), and Mark R. Fuller (U.S. Fish and Wildlife Service, Patuxent Wildlife Research Center, Laurel, Maryland 20708. Phone: 301-498-0282).

The Cooper's Hawk (Accipiter cooperii) is variously considered common, rare, threatened, or endangered by a variety of public and private conservation agencies. We located and sampled habitat characteristics at 164 Cooper's Hawk nest sites in several areas of the eastern deciduous forest (Maryland, Wisconsin, Pennsylvania, Connecticut, and New York) from 1979 to 1984. Our studies indicate that nest sites are not selected at random from the available habitat based on forest structure, composition, and physiographic features. However, considerable variability is evident in nest sites used such that nest site habitat is not likely to be limiting to this population. Implications for forest management are discussed.

Lifetime production of Sparrowhawks.

IAN NEWTON (Institute of Terrestrial Ecology, Monks Wood Experimental Station, Abbots Ripton, Huntingdon, Cambs. PE17 2LS, United Kingdom. Phone: 04873-381).

During a long-term study of the European Sparrowhawk (Accipiter nisus), the total number of young produced in a lifetime was measured in a large number of females. These females were typical, in terms of longevity, of the whole female population. They varied enormously in productivity: some raised no young during their lifetimes, whereas others raised up to 23. For each generation of fledglings, about 72% died before they could reach breeding age, 4.5% attempted to breed but were unsuccessful, and the remaining 23.5% raised at least one young. Lifetime productivity was influenced mainly by longevity (up to 11 years), but also by age of first breeding (1-4 years), and production at individual attempts (0-6 young). Other raptor species, which have been studied over several years, have also shown great individual variation in productivity. In the conservation of rare species, it would be wise to find the most productive pairs and give special protection to them.

The return of raptor populations of the Atlantic and Delaware Bay coast of New Jersey.

LAWRENCE NILES, JoAnn Frier-Murza, Richard Browne, and Paul D. McLain (New Jersey Division of Fish, Game and Wildlife, Endangered and Nongame Species Program, Trenton, New Jersey 08625. Phone: 609-292-9400).

As late as 1950, 500 pairs of Ospreys and 22 pairs of Bald Eagles nested in the 120 miles of salt and brackish marshes of the Atlantic and Delaware Bay coasts. Northern Harriers were widespread on both coasts. By 1970, Ospreys fell to less than 50 nests, the Harrier to 17 nests, and the Bald Eagle to 1 nest. The ban on persistent pesticides, habitat protection, and nest site construction and management increased Ospreys to over 110 nests in 1985 and Harriers to 45 nests. The Peregrine Falcon was introduced in 1977 and by 1985 successfully fledged young from 5 nests. The Bald Eagle population remains at 1 nest which has been managed for the last 4 years. Twenty-six eagles have been hacked in the last 3 years. Although an aggressive habitat protection and management program was added to the project, the Bald Eagle will prove more difficult to restore since historic eagle habitat is threatened by development.

Golden Eagle (Aquila chrysaetos) sheep (Ovis aries) predation in southwestern Montana.

Bart W. O'Gara and MARC R. MATCHETT (Montana Cooperative Wildlife Research Unit, University of Montana, Missoula, Montana 59812. Phone: 406-243-5372).

Losses from Golden Eagle predation on lambs were extensive during 1974 and 1975 on two ranches near Dillon, Montana. From 1976 through 1981 low levels of predation were documented, and eagles were trapped and relocated by the U.S. Fish and Wildlife Service. Trapping and relocating eagles was expensive and had little proven effect on predation rates. Biologists experimented with eagle chitter and distress calls and aerial harassment in 1983, but neither reduced predation rates. Human-like scarecrows accompanied by ground harassment apparently reduced or eliminated depredation in 1984. Results from experimental tests in 1985 indicated that scarecrows and harassment are the best available means to prevent eagle depredations.

Raptor collisions with utility lines: an analysis using subjective field observations.

RICHARD R. OLENDORFF (U.S. Bureau of Land Management, 2800 Cottage Way, Sacramento, California 95825. Phone: 916-978-4725) and Robert N. Lehman (U.S. Bureau of Land Management, 555 Leslie Street, Ukiah, California 95482. Phone: 707-462-3873).

Between January 1984 and September 1985 a Call for Information pertaining to the problem of raptor collision with power lines was circulated to 175 biological and ornithological journals in 28 countries throughout the world, to 1,500 members of the North American Falconers' Association, and to over 300 wildlife/raptor rehabilitation facilities throughout the United States. A Raptor Collision Report Form was then developed for distribution to individuals responding to the Call for Information. Almost 250 responses to the Call for Information were received. Over 400 report forms were distributed. One hundred and

twenty-one report forms were returned; to the best of our ability 88 of these were judged to be case histories of collision, or collision with subsequent electrocution (as opposed to electrocution alone). Peregrine Falcons, Bald Eagles, Golden Eagles, Red-tailed Hawks, and Ospreys accounted for 62 (70.4%) of suspected collisions. Reports were for the most part evenly distributed with respect to time of year, however, peaks occurred in March and October. Only one bird of 81 (1.2%), for which health at the time of the suspected collision was evaluated, was in questionable health. Weather was cited as a possible factor in 7 (18.4%) of the 38 accounts in which information about weather was recorded. Of 76 birds for which age class was recorded at the time of the suspected collisions, 42 (55.3%) were adults, and 34 (44.7%) were subadults. In 72 of the 88 accounts the type of utility line was identified. Ten (13.9%) were telephone lines, 36 (50%) were electric distribution lines, and 26 (36.1%) were electric transmission lines.

Introduction of Merlins (Falco columbarius) into North American cities.

LYNN W. OLIPHANT (Department of Veterinary Anatomy, University of Saskatchewan, Saskatoon, Saskatchewan S7N 0W0. Phone: 306-966-7412).

Merlins have successfully established natural urban breeding populations in several prairie cities in Canada. A single experimental release of six Merlins using basic hack techniques was made in Regina, Saskatchewan, in 1978 after an intensive survey indicated there were no nesting Merlins. By 1983 a breeding population of about five pairs was present, presumably the result of this single release. Saskatchewan is considering the possibility of a transfer of nestling Merlins to the United States to attempt their introduction into a small number of urban areas.

Methodologies for assessing bird collisions with transmission lines.

DANIEL C. PEARSON (Southern California Edison Company, Environmental and Regulatory Affairs, Room 459, P.O. Box 800, Rosemead, California 91770. Phone: 818-302-3870).

Southern California Edison's (SCE) Devers-Valley-Serrano 500-kV Transmission Line crosses the San Jacinto Valley in southern California. Studies performed by SCE in support of the permitting of this line identified this valley as a heavy bird use area for wintering and migratory birds. These studies, utilizing a radar and night vision scope for measuring nocturnal bird movement, estimate that on any given night during the spring migration approximately 205,000 birds may cross the transmission line. The magnitude of bird traffic in this area prompted the California Public Utilities Commission and SCE to initiate a study to determine bird collision mortality and, based on the results, develop appropriate mitigation. Past efforts at assessing bird collision mortality have relied on searching for and finding dead birds. Problems with this method include bird detectability, observer bias, scavenger removal, etc. SCE in its study of bird collisions with this transmission line has also established as an objective the ability to develop a new methodology for assessing bird mortality. Efforts have concentrated on the use of video cameras for diurnal monitoring and video in conjunction with night vision scopes for nocturnal assessment. A variety of camera lens and lighting schemes are also being tested. All monitoring is being performed from an elevated

position using a portable meteorological tower. The effectiveness of this methodology is being tested with a radar-night surveillance system. Equipment testing is underway, with deployment and testing on the transmission line scheduled for 1986.

Current issues concerning management of Golden Eagles in the West.

Robert L. Phillips (U.S. Fish and Wildlife Service, Denver Wildlife Research Center, Box 916, Sheridan, Wyoming 82801. Phone: 307-672-5826).

This paper presents an overview of the problems facing eagles, primarily goldens, during the 1980s in the western United States. Electrocution, illegal shooting, and poisoning continue to be the major causes of eagle mortality. Continuing cooperative efforts between government and industry appear to be lessening the impact of the electrocution problem in many areas. Conservation education and law enforcement activities are credited with reducing mortality from shooting and poisoning. Increased demand for eagle feathers and other parts by American Indians has posed new problems for law enforcement officials. The most serious problem facing eagles today is the reduction of nesting and hunting habitats associated with an expanding human population. Accelerated development of western energy reserves has caused many conflicts with raptors, but most of these have been resolved through successful mitigation efforts.

Assessing impacts and planning mitigation.

BONNIE C. POSTOVIT and Howard R. Postovit (Powder River Eagle Studies, Box 2411, Gillette, Wyoming 82716. Phone: 307-686-6178).

Impact assessment and mitigation programs need to be approached in a scientific manner. Impact studies often suffer from poor design or are based on circumstantial data. When assessing impacts, researchers should evaluate: 1) type and extent of disturbance, 2) visibility of disturbance, 3) duration and timing of disturbance, 4) species and individual sensitivity and ability to habituate, and 5) influence of environmental factors. More experimental, controlled disturbance studies should be conducted. Mitigation planning should be an analytical process. The easiest technique to employ may not always be the right choice. To improve mitigation programs, four steps are recommended: 1) define the problem, 2) set goals, 3) evaluate and select mitigation methods, and 4) monitor the results. Both impacts and mitigation should be analyzed on a case-by-case basis.

Relocating young or nests: techniques for mitigating nest site destruction.

HOWARD R. POSTOVIT and Bonnie C. Postovit (Powder River Eagle Studies, Box 2411, Gillette, Wyoming 82716. Phone: 307-686-6178).

The intent of this type of mitigation is to prompt individual raptor pairs to use a new nest site at a selected location. Techniques for relocating young and nests were developed and have been used to resolve several site-specific conflicts between surface coal mining and Golden Eagle (Aquila chrysaetos) nesting in northeast Wyoming. Nine of twelve Golden Eagle nest site relocations attempted have met with some degree of success, with adults returning to nest at relocation sites in following

position using a portable meteorological tower. The effectiveness of this methodology is being tested with a radar-aided surveillance system. Equipment testing is underway, with deployment and testing on the transmission line scheduled for 1983.

Current issues concerning management of Golden Eagles in the West. Robert J. Hickey (U.S. Fish and Wildlife Service, Denver Wildlife Research Center, Box 918, Sheridan, Wyoming 81801. Phone: 307-673-5836). This paper presents an overview of the problems facing eagles, particularly golden eagles, during the 1980s in the western United States. Reasons for the decline of eagles, including poisoning, and poisoning continue to be the major cause of eagle mortality. Continuing cooperative efforts between government and industry appear to be increasing the impact of the electrocution problem in many areas. Conservation education and law enforcement activities are credited with reducing mortality from shooting and poisoning. Increased demand for eagle feathers and other parts by American Indians has posed new problems for law enforcement officials. The most serious problem facing eagles today is the reduction of nesting and hunting habitats associated with an expanding human population. Accelerated development of western energy resources has caused many conflicts with raptors, but most of these have been resolved through successful mitigation efforts.

Assessing impacts and planning mitigation. RONNIE C. POSTOVIT and Howard R. Postovitz (Powder River Eagle Studies, Box 2411, Gillette, Wyoming 81715. Phone: 307-686-6178). Impact assessment and mitigation programs need to be approached in a scientific manner. Impact studies often suffer from poor design or are based on circumstantial data. When assessing impacts, researchers should evaluate: 1) type and extent of disturbance, 2) viability of disturbance, 3) duration and timing of disturbance, 4) species and individual sensitivity and ability to tolerate, and 5) influence of environmental factors. More experimental, controlled disturbance studies should be conducted. Mitigation planning should be an analytical process. The scientific approach to eagle mitigation is the right choice. To improve mitigation programs, four steps are recommended: 1) define the problem, 2) set goals, 3) evaluate and select mitigation methods, and 4) monitor the results. Both impacts and mitigation should be analyzed on a case-by-case basis.

Relocating young of eagles: techniques for mitigating nest site destruction. HOWARD R. POSTOVIT and RONNIE C. POSTOVIT (Powder River Eagle Studies, Box 2411, Gillette, Wyoming 81715. Phone: 307-686-6178). The intent of this type of mitigation is to prevent individual raptor pairs to use a nest site at a selected location. Techniques for relocating young and nests were developed and have been used to resolve several site-specific conflicts between surface coal mining and Golden Eagle (*Haliaeetus leucocephalus*) nesting in northern Wyoming. Nine of twelve Golden Eagle nest site relocations attempted have met with some degree of success, with adults returning to nest at relocation sites in following

years. Attempts to relocate nests or young of other species have been made, but have resulted in limited success. Apparently, some species are more susceptible to management by these techniques than others. Although the application of these techniques is very limited, these mitigation strategies appear to have utility in certain situations. Linear disturbances (e.g., railroads and pipelines) appear to be the best candidates for this type of mitigation.

Raptor reproductive success: some problems with methods, criteria, and terminology--a reevaluation and update.

SERGEJ POSTUPALSKY (Department of Wildlife Ecology, University of Wisconsin, Madison, Wisconsin 53706. Phone: 608-221-8228).

A standard terminology for describing the status of nests and territories, and standard criteria for calculating reproductive success, were proposed at the First Raptor Research Foundation Conference on Raptor Conservation Techniques in 1973. Since then the proposed terminology and criteria have been widely used, modified, and applied to many species. In this paper I reevaluate the original terms and update them as I currently use them. Time will be available after my presentation for floor discussion of reproductive terminology and criteria as used by others.

Effects of raptor nests on coal leasing in northwest New Mexico.

JAMES M. RAMAKKA (U.S. Bureau of Land Management, 900 La Plata Highway, Farmington, New Mexico 87499. Phone: 505-325-3581) and Joel Medlin (U.S. Fish and Wildlife Service, Washington, D.C. 20240).

Three Federal coal unsuitability criteria deal specifically with raptor species. Three other criteria deal with endangered species or "high interest" species which may include raptors. In the San Juan Basin of New Mexico approximately 4,100 acres of coal lands were declared unsuitable for surface mining due to the presence of raptor nests (Ferruginous Hawk, Golden Eagle, and Prairie Falcon). Problems encountered in application of the coal unsuitability criteria included: lack of inventory data, yearly changes in some nest locations, and limited time frames and guidance for establishment of buffer zones. Monitoring of nests since 1981 has located new nests (84 monitored in 1985, as opposed to 28 in 1981), indicating that many previously active territories are now inactive. The high dollar value of the coal resource accentuates the need for accurate and current data. Researchers can facilitate knowledgeable decisions by line managers by providing information on inventory techniques, acceptable buffer distances from large-scale disturbances, and recommended mitigation and reclamation measures. A cooperative effort by industry, the research community, and government regulatory agencies is needed to ensure adequate consideration of raptors in the coal development process. Suggestions for such an effort are presented.

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Major reproductive success: some problems with methods, criteria, and technology--a revision and update.
BERRY, PORTLAND (Department of Wildlife Ecology, University of Wisconsin, Madison, Wisconsin 53706. Phone: 608-251-8528).
A standard technology for describing the status of nests and territories, and standard criteria for calculating reproductive success, were proposed at the first Raptor Research Foundation Conference on Raptor Conservation Techniques in 1973. Since then the proposed technology and criteria have been widely used, modified, and applied to many species. In this paper I reexamine the original forms and update them as I currently use them. This will be available after my presentation for floor discussion of reproductive technology and criteria as used by others.

Effects of raptor nests on coal mining in northwest New Mexico.
JAMES R. WATKINS (U.S. Bureau of Land Management, 700 La Plata Highway, Durango, New Mexico 87009. Phone: 303-352-3581) and Joel Mallin (U.S. Fish and Wildlife Service, Washington, D.C. 20240).
Three Federal land ownership areas deal specifically with raptor species. These areas include the San Juan Basin of New Mexico, which contains approximately 1,100 acres of coal lands were declared unsuitable for surface mining due to the presence of raptor nests (Fertigman 1981). Golden Eagle, and Prairie Falcon). Problems encountered in application of the coal management criteria included: lack of inventory data, yearly changes in nest locations, and limited time frames and guidance for establishment of buffer zones. Monitoring of nests since 1981 has located new nests (as outlined in 1985, as opposed to 12 in 1981). The high dollar value of the coal resources necessitates the need for accurate and current data. Researchers can facilitate knowledge decisions by line managers by providing information on inventory techniques, acceptable buffer distances from large-scale disturbances, and recommended mitigation and reclamation measures. A cooperative effort by industry, the research community, and government regulatory agencies is needed to ensure adequate cooperation of raptors in the coal development process. Suggestions for such an effort are presented.

Effectiveness of taped calls in detecting nesting Cooper's Hawks (Accipiter cooperii).

Robert N. Rosenfield (College of Natural Resources, University of Wisconsin, Stevens Point, Wisconsin 54481. Phone: 715-824-3114) and JOHN BIELEFELDT (5357 Highway 2C, Dousman, Wisconsin 53118. Phone: 414-965-3755).

Response rates of nesting Cooper's Hawks to human presence with broadcasted taped-recordings of the birds' alarm calls, and without broadcasted calls, was studied near eight active nests in Wisconsin. To simulate the situation of most resource managers, we used observers with some experience in raptor studies, but little or none with nesting Cooper's Hawks. Observers, unaware of nest location, made four predetermined stops along a transect near each nest. Paired tape and non-tape trials were run at both incubation and nestling stages. During incubation, there were no detectable responses to either tape or non-tape conditions. At the nestling stage, the observer without tapes detected responses to his presence at a single nest, while the observer using tapes detected responses at four nests. Although taped calls are not infallible, they would be an important aid to resource managers in detecting nesting Cooper's Hawks.

Swainson's Hawk (Buteo swainsonii) habitat relationships in agricultural regions of California.

RONALD W. SCHLORFF (California Department of Fish and Game, 1416 Ninth Street, Sacramento, California 95814. Phone: 916-322-1261).

Swainson's Hawk breeding populations have declined in California since the beginning of this century. Habitat destruction is assumed to be a major cause of the decline, both in California and on the South American wintering ground. The habitat relationships of breeding Swainson's Hawks have been studied in California since 1979. Agricultural development has replaced much suitable nesting and foraging habitat but certain crops do appear to be compatible with the species' needs. The need to protect certain crops often precipitates actions which destroy Swainson's Hawk habitat (e.g., riparian vegetation removal associated with bank protection to prevent loss of orchards). Since many nest trees that exist in an agricultural setting may be prevented from reproducing, protection of nesting habitat within riparian systems and elsewhere is essential in order to prevent extirpation of this species from California.

Population change of Golden Eagles in San Diego County from 1928-1978.

THOMAS A. SCOTT (Department of Forestry and Resource Management, University of California, Berkeley, California 94720. Phone: 415-642-5344).

The Golden Eagle (Aquila chrysaetos) population breeding in western San Diego County has declined by approximately one-third since 1928. Nest disturbance and subsequent abandonment appear to be the primary causes of pair loss, occurring before widescale alteration of home range. Breeding pairs adjust to nest disturbance by reducing their number of nest locations and shifting their primary nest sites. They eventually abandon all nest locations, but have remained in home ranges for up to five years without breeding. Abandoned home ranges have been reoccupied, but only for relatively short periods with no documented breeding success. The fixed

Robert M. Rosenfield (College of Natural Resources, University of Wisconsin, Stevens Point, Wisconsin 54481. Phone: 715-824-3114) and John H. Hume (2557 Highway 10, Potosi, Wisconsin 53120. Phone: 414-925-1737).

Responses of nesting Cooper's Hawks to human presence with broad-leaved saplings of the birds' alarm calls, and without broad-leaved saplings, was studied near eight active nests in Wisconsin. To simulate the alarm of some resource managers, we used observers with some experience in forest management, but little or none with nesting Cooper's Hawks. Observers, standing at least 100m from the nest, made four predetermined stops along a transect each day. Paired tape and non-tape trials were run at both incubation and fledging stages. During incubation, there were no detectable responses to either tape or non-tape conditions. At the fledging stage, the observer without tape detected responses to his presence at a single nest, while the observer using tape detected responses at four nests. Although taped calls are not realistic, they would be an important aid to resource managers in detecting nesting Cooper's Hawks.

Swainson's Hawk (*Buteo swainsoni*) habitat relationships in agricultural regions of California.
 RICHARD W. SWAINSON (California Department of Fish and Game, 1415 West Street, Sacramento, California 95814. Phone: 916-922-1201).
 Swainson's Hawk breeding populations have declined in California since the beginning of this century. Habitat destruction is assumed to be a major cause of the decline, both in California and on the South American wintering grounds. The habitat relationships of breeding Swainson's Hawks have been studied in California since 1979. Agricultural development has replaced much suitable nesting and foraging habitat but certain crops appear to be compatible with the species' needs. The need to protect certain crops often precludes actions which destroy Swainson's Hawk habitat (e.g., riparian vegetation removal associated with bank protection to prevent loss of orchards). Since many nest trees exist in an agricultural setting may be prevented from reproduction, protection of nesting habitat within riparian systems and elsewhere is essential in order to prevent extinction of this species from California.

Population change of Golden Eagles in San Diego County 1978-1979.
 WILSON A. BOOTH (Department of Forestry and Resource Management, University of California, Berkeley, California 94720. Phone: 415-842-3344).
 The Golden Eagle (*Haliaeetus leucocephalus*) population breeding in western San Diego County has declined by approximately one-third since 1973. Nest abandonment and subsequent abandonment appear to be the primary causes of pair loss, occurring before widespread migration of home range. Breeding pairs adjust to nest disturbance by reducing their number of nest locations and shifting their primary nest sites. They eventually abandon all nest locations, but have remained in home ranges for up to five years without breeding. Abandoned home ranges have been resurveyed, but only for relatively short periods with no documented breeding success. The trend

nesting pattern of the breeding population causes disturbed pairs to make nest adjustments within their home range; the breeding population does not change its overall dispersion to compensate for disturbance suffered by specific pairs.

Studies of human disturbance on raptors: a review of techniques.

THOMAS A. SCOTT (Department of Forestry and Resource Management, University of California, Berkeley, California 94720. Phone: 415-642-5344).

Studies reviewed in this paper are grouped into three categories: 1) descriptive studies, which report observations on disturbance and subsequent reactions by raptors, 2) comparative studies, which analyze effects of disturbance among raptors in "treatment" and "control" groups, and 3) manipulative studies, which create specific types of disturbance and monitor the results. The object species in these studies is most often (37% of total) the Bald Eagle (Haliaeetus leucocephalus). The most common, yet striking results are the variability of raptor response and their ability to habituate to certain forms of disturbance. The majority of work completed is descriptive, arising from environmental review of specific projects. Comparative and manipulative studies are far less common and are typically complicated by high sample variance and difficulties quantifying and defining human disturbance. Most studies are not published, thus most experimental methods and results are not subject to review and use by researchers and managers in the field.

The California Natural Diversity Data Base: a data management tool for raptor conservation.

CARRIE ANNE SHAW (Natural Diversity Data Base, California Department of Fish and Game, 1416 Ninth Street, Rm. 1225, Sacramento, California 95814. Phone: 916-322-2493).

The Natural Diversity Data Base (NDDB) is a statewide manual and computerized inventory of location and condition information on California's most sensitive animals, plants, and biotic communities. In cooperation with the Department's Endangered Species and Nongame Biologists, NDDB currently maintains databases for 11 sensitive birds of prey found within California, including Swainson's Hawk, Bald Eagle, and Great Gray Owl. Data record contents and computerized products are discussed. Local, state, and Federal agencies, consulting firms, conservation groups, and individuals involved in resource management and land-use planning are using NDDB as the centralized source of sensitive species information. Much more raptor data need to be collected and computerized to protect these sensitive birds of prey. With the cooperation and support of raptor specialists and wildlife biologists throughout California, NDDB can become a more effective conservation tool.

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specific pairs.

Studies of human disturbance on raptors: a review of techniques
THOMAS A. SCOTT (Department of Forestry and Resource Management, Uni-
versity of California, Berkeley, California 94720. Phone: 845-5244).
Studies reviewed in this paper are grouped into three categories:
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often (85% of total) the Bald Eagle (*Haliaeetus leucocephalus*). The most
common, yet striking results are the variability of raptor response and
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The California Natural Diversity Data Base: a data management tool for
raptor conservation.
CAROL ANN SHAW (Natural Diversity Data Base, California Department of
Fish and Game, 1415 Ninth Street, San Francisco, California 94114.
Phone: 392-3200).
The Natural Diversity Data Base (NDDB) is a statewide annual and non-
published inventory of location and condition information on California's
most sensitive animals, plants, and other communities. In cooperation
with the Department's Endangered Species and Fisheries Divisions, NDDB
currently maintains databases for 11 sensitive birds of prey found within
California, including Swainson's Hawk, Bald Eagle, and Great Gray Owl.
Data record sensitive and non-sensitive plants, communities, groups, and
species, and Federal agencies, non-Federal groups, and individuals
involved in resource management and land-use planning are
using NDDB as the centralized source of sensitive species information.
With more raptor data used to be collected and computerized to protect
these sensitive birds of prey. With the cooperation and support of raptor
specialists and wildlife biologists throughout California, NDDB can become
a more effective conservation tool.

Reestablishment of the Harris' Hawk (Parabuteo unicinctus superior) to the Lower Colorado River.

GLENN R. STEWART (Ventana Wilderness Sanctuary. P.O. Box 894, Carmel Valley, California 93924. Phone: 408-429-2466) and Brian J. Walton (The Peregrine Fund/Predatory Bird Research Group, Lower Quarry, University of California, Santa Cruz, California 95064. Phone: 408-429-2466).

One hundred five Harris' Hawks were released at hack sites and cross-fostered to Red-tailed Hawks in an effort to reestablish a native population along the lower Colorado River in California and Arizona from 1979 to 1985. "Mega-hack" releases were tested as were other hacking techniques. Released birds have paired and produced young on at least two occasions since the program was initiated. Selected individuals were marked with color bands and radio-telemetry transmitters to determine success in gaining independence and to monitor individuals and their movements after release.

Managing habitats for complex raptor guilds in eastern forests.

KIMBERLY TITUS (Department of Wildlife Biology, Virginia Polytechnic Institute, Blacksburg, Virginia 24061. Phone: 703-961-5046), Mark R. Fuller (U. S. Fish and Wildlife Service, Patuxent Wildlife Research Center, Laurel, Maryland 20708. Phone: 301-498-0282), Michael Root and Peter DeSimone (National Audubon Society, Miles Wildlife Sanctuary, RRI Box 295, West Cornwall Road., Sharon, Connecticut 06069. Phone: 203-364-5302), Janet Britt (526 N 16th E., Riverton, Wyoming 82501. Phone: 307-856-5064), and James A. Mosher (Savage River Consulting, P.O. Box 71, Frostburg, Maryland 21532. Phone: 301-689-2875).

Managing forested habitats for maintaining high raptor diversity has not been undertaken in the eastern United States. At least six species nest in northwest Connecticut, and we quantified nesting habitat from nest sites of Buteo platypterus (n = 7), B. lineatus (n = 25), B. jamaicensis (n = 9), Accipiter gentilis (n = 30), A. cooperii (n = 7), and Strix varia (n = 21). Results indicated habitat partitioning among species. B. lineatus and S. varia used specialized and perhaps sensitive habitats (e.g., wetlands). Characterizing "typical" habitat for other species such as A. cooperii was difficult because of small sample sizes and use of a variety of nesting habitats. Ordinations indicated that these six species occupied essentially all forested habitats. Managing for a single species in eastern forests is not practical considering the species' requirements and the complexity of the raptor guild and the forest.

Limiting factors in raptor management.

ANDY VILLAGE and Ian Newton (Institute of Terrestrial Ecology, Monks Wood Experimental Station, Abbots Ripton, Huntingdon, Cambs. PE17 2LS, United Kingdom. Phone: 04873-381).

To effectively manage raptor populations it is necessary to identify the factors that limit population size. In most populations these are likely to be either food supply or nest-site availability. Populations depleted by persecution or pesticide usage may also be limited by high adult mortality, insufficient productivity, or insufficient immigration. The factors limiting a species may vary from year to year and from place

to place. This is illustrated by reference to the European Kestrel (Falco tinnunculus) which was studied in three habitats for several years. Breeding density was correlated with food supply, which was probably the ultimate limiting factor in all three habitats. However, provision of artificial nest-sites and removal experiments indicated that the proximate factors involved were nest site availability and territorial behavior in grassland, but a shortage of breeding males in arable farmland.

Roost site characteristics and roosting behavior of wintering Merlins.

IAN G. WARKENTIN (Department of Biology, University of Saskatchewan, Saskatoon, Saskatchewan, Canada S7N 0W0. Phone: 306-966-7414).

Telemetry was used to study the ecology of Merlins (Falco columbarius) overwintering in Saskatoon, Saskatchewan. Ten Merlins were trapped in the city, during the winters of 1983-84 and 1984-85, and were fitted with a radio transmitter mounted on the two central rectrices. All birds radio-tagged depended upon mature spruce trees, planted in residential areas of the city, for roosting sites. The consistency of return to the same roost site each night (for an individual Merlin) varied from continual use of the same site to repeated change. Entry times at the roost by Merlins could be accounted for to a large extent by environmental variables, especially light intensity and temperature. To a lesser extent the variation in departure times could be explained by these same variables.

Bald Eagle (Haliaeetus leucocephalus) nesting habitat management in Southeast Idaho.

MICHAEL B. WHITFIELD (White River National Forest, 0094 County Road 244, Rifle, Colorado. Phone: 303-625-2371).

The Greater Yellowstone Ecosystem (GYE) Bald Eagle Working Group produced guidelines for the development of site specific management plans for the nearly 60 breeding territories found within the GYE. As the initial step in site plan development, habitat use and activity budgets at three Southeast Idaho territories were determined through 118 days of observations. The resulting plan implements resource coordination measures and silvicultural prescriptions for the three existing territories and two potential recovery areas. Habitat use monitoring and banding at all 15 Southeast Idaho breeding territories have yielded information on habitat use, productivity, prey selection, and juvenile movements.

to place. This is illustrated by reference to the European kestrel (*Falco tinnunculus*) which was studied in three habitats for several years. Breeding density was correlated with food supply, which was probably the ultimate limiting factor in all three habitats. However, provision of artificial nest-sites and removal of vegetation indicated that the proximate factors involved were nest availability and territorial behavior in general, but a shortage of breeding sites in stable farmland.

Recent site characteristics and roosting behavior of wintering kestrels. IAN G. WARDLAW (Department of Biology, University of Saskatchewan, Saskatoon, Saskatchewan, Canada S7N 0W6. Phone: 526-7411). Fieldwork was used to study the ecology of kestrels (*Falco tinnunculus*) overwintering in Saskatchewan. Ten kestrels were trapped in the city, during the winters of 1983-84 and 1984-85, and were fitted with a radio transmitter mounted on the two central vertebrae. All birds radio-tagged roosted upon mature spruce trees, planted in residential areas of the city, for roosting sites. The consistency of return to the same roost sites each night (for an individual kestrel) varied from continual use of the same site to repeated changes. Entry times at the roost by kestrels could be accounted for to a large extent by environmental variables, especially light intensity and temperature. To a lesser extent the variation in departure times could be explained by these same variables.

Field Ecology of Bald Eagles (*Haliaeetus leucocephalus*) Roosting Habitat Management in Southern Idaho. MICHAEL B. WILKINSON (White River National Forest, Owyhee County, Idaho, 83424, Idaho, U.S.A. Phone: 505-475-7371). The Wyoming Baldpate Recovery Team (WYBRT) Bald Eagle Working Group produced guidelines for the development of site specific management plans for the nesting and roosting habitats found within the WYBRT. As the initial step in site development, habitat use and activity budgets at three roosting sites were determined through 118 days of observation. The resulting plan implements resource conservation measures and alternative prescriptions for the three existing roosting sites and two potential recovery sites. Habitat use monitoring and banding at all 15 roosting sites during wintering have provided information on habitat use, productivity, prey selection, and juvenile movements.

Habitat utilization of the Goshawk (Accipiter gentilis) in managed boreal forests of Sweden.

PER WIDÉN (Grimsö Wildlife Research Station, S-770 31 Riddarhyttan, Sweden. Phone: 0581-92065).

Modern forest management in Sweden causes dramatic changes of the forest habitat. Two major trends are a decreasing amount of mature forest and an increased fragmentation. The effects on raptors of these major changes are largely unknown. Therefore, habitat utilization of Goshawks was studied in an area of managed boreal forest in central Sweden using radio-telemetry. Data were collected during September-June in 1977-1981. Goshawks showed a strong preference for large patches of old mature forest. Further, they avoided edges. Kills made by radio-tagged Goshawks showed the same habitat and patch-size distribution as did Goshawk locations in general. They showed no major preference with respect to tree species composition of the forest. Thus, my data indicate that the Goshawk may be negatively affected by modern forest management.

1985 RAPTOR RESEARCH FOUNDATION
SYMPOSIUM ON THE MANAGEMENT OF BIRDS OF PREY
INTERNATIONAL MEETING

Saturday, November 9 and Sunday, November 10
Symposium on the Biology, Status, and Management of Owls



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* ABSTRACTS *

SESSION 11.

SYMPOSIUM ON THE BIOLOGY, STATUS, AND MANAGEMENT
OF OWLS

November 9-10, 1985
Sacramento, California

Hosted by:

Raptor Research Foundation, Inc.,
and the
U.C. Davis Raptor Center

Held in conjunction with the 1985 Raptor Research Foundation Symposium
on the Management of Birds of Prey, International Meeting

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U.S. Fish and Wildlife Service
The Western Foundation of Vertebrate Zoology

Range overlap of the Spotted Owl (Strix occidentalis caurina) and the Barred Owl (Strix varia) in Washington and implications for the future.

HARRIET L. ALLEN (Washington Department of Game, 708 40th St., N.W., Marysville, Washington 98270. Phone: 206-653-8290), Tom Hamer (2285 Hoehn Road No. 53, Sedro Woolley, Washington 98284. Phone 206-856-0419), and Larry W. Brewer (Washington Department of Game, 895 N. Smith Rd., Stanwood, Washington 98292. Phone: 206-676-3547).

Barred owls have been expanding their range into western North America during the last 20 years, and with their entry into southern British Columbia, Washington, Oregon, and California, they now exist in the entire range of the Northern Spotted Owl. The first breeding record in Washington was in 1974; by 1985 there were over 130 documented occurrences of Barred Owls in Washington; 90 of these overlapped Spotted Owl range. Of the occurrences within the range of the Spotted Owl, a minimum of 40 are adjacent to or within known Spotted Owl territories. Instances of Barred Owls occupying territories previously occupied by Spotted Owls have been documented. Preliminary indications of competition for food resources and nest sites are discussed.

Prey selection in breeding Spotted Owls (Strix occidentalis).

CAMERON W. BARROWS (The Nature Conservancy, 42101 Wilderness Road, Branscomb, California 94517. Phone: 707-984-6653).

I examined patterns in the diets of breeding and nonbreeding Spotted Owls to determine the importance of random versus preferential prey selection. My analysis showed an increase for breeding pairs in the large prey component in the owls' diet from spring to summer; nonbreeding Spotted Owls consistently showed a decrease in large prey selected over the same seasons. These data support a hypothesis of selective predation in explaining observed dietary patterns; however, they do not exclude a hypothesis of differential prey availability and random predation. I tested these conflicting hypotheses using natural experiments (breeding failures) to control for potential seasonal variation in prey size availability. The hypothesis of exclusive nonpreferential or random predation was rejected.

Population ecology of the Common Barn Owl (Tyto alba pratincola) in coastal southern California.

PETER H. BLOOM (National Audubon Society, Condor Research Center, 2291-A Portola Road, Ventura, California 93003. Phone: 805-644-1766).

Research on the Common Barn Owl was undertaken between 1970 and 1985 to examine breeding biology, demography, food habits, and dispersal of young from nests. Early egg collectors occasionally mentioned atypical years when Barn Owls seemed to produce more eggs than usual. While rumored, this has never been quantified. The current study attempts to document this more typically arctic phenomenon whereby owls produce supernumerary clutches of eggs every 4-5 years. Causes of this relatively predictable cycle in California are unknown but are probably related to numbers of voles and, possibly, gophers.

Home range size and habitat use of Northern Spotted Owls (Strix occidentalis caurina) in Washington.

LARRY W. BREWER (Washington Department of Game, 895 N. Smith Rd., Stanwood, Washington 98292. Phone: 206-676-3547) and Harriet L. Allen (Washington Department of Game, 708 40th St., N.W., Marysville, Washington 98270. Phone: 206-653-8290).

Radio telemetry data on the year-round movements of 16 adult Northern Spotted Owls in Washington were analyzed using minimum convex polygon and harmonic mean methods to determine seasonal and annual home range size. Mean individual summer range was 870 ha. Home range size expanded during winter in all cases. For some individuals winter ranges were expansions into areas adjacent to summer ranges. In other cases, owls migrated to areas 16-32 km away from summer ranges. Mean individual winter range was 1,663 ha. The annual individual home range averaged 1,950 ha. Mean annual home range size of 5 pairs was 2,776 ha. Habitat within home ranges was assessed using satellite imagery. Within individual home ranges there was an average of 589 ha of old growth coniferous forest habitat. Home ranges of owl pairs contained an average of 951 ha of old growth. Eighty-one percent of total owl locations were in old-growth habitat.

Ecology of Great Gray Owls (Strix nebulosa) in northeastern Oregon.

EVELYN L. BULL (Pacific Northwest Research Station, Forestry and Range Sciences Laboratory, La Grande, Oregon 97850. Phone: 503-963-7122), and Mark G. Henjum (Oregon Department of Fish and Wildlife, La Grande, Oregon. Phone: 503-963-2138).

Fifty-two nests of Great Gray Owls (Strix nebulosa) located since 1982 were on the following structures: 50% old raptor nests, 21% artificial wooden platforms, 19% broken-topped dead trees, and 10% mistletoe clumps. Nest habitat ranged from mixed conifer to ponderosa pine (Pinus ponderosa) to lodgepole pine (Pinus contorta). Stands surrounding nests ranged from partial cuts to old growth. Diet during the breeding season consisted of 58% voles (Microtus spp.) and 34% pocket gophers (Thomomys talpoides). Eleven juveniles carrying radio transmitters traveled a maximum distance of 8.8-31.4 km, and 11 adults with transmitters traveled 3.1-42.9 km from their nests in one year.

Systematics of the Strigidae.

SADIE COATS and Peter F. Cannell (American Museum of Natural History, Central Park West at 79th Street, New York, New York 10024. Phone: 212-873-1300).

The commonly followed classification of the Strigidae by Peters (1940) conveys little phylogenetic information. A classification based on osteology proposed by Ford (1967, University of Michigan Ph.D. thesis) conflicts in some of its groupings with Peters. Peters placed Strix and Ciccaba in different subfamilies; Ford lumped them into one genus. Ford suggested a new subfamilial division, including a third subfamily, the Surniinae. Current study of syringeal morphology supports Ford's classification for many genera and provides a more detailed cladogram. This talk will briefly present and compare views of strigid phylogenetic relationships based mainly on osteology and syrinx morphology.

A comprehensive research effort on the Common Barn Owl (Tyto alba).

BRUCE A. COLVIN (Department of Biological Sciences, Bowling Green State University, Bowling Green, Ohio 43404. Phone 419-372-8375) and Paul L. Hegdal (U.S. Fish and Wildlife Service Wildlife Research Center, Bldg. 16, Federal Center, Denver, Colorado 80225. Phone: 303-236-7809).

Common Barn Owl populations have declined in the Midwest. Our 1,150-km² New Jersey study area is providing data for comparison to midwest states. From 1980-1985 we documented 284 nestings among 107 sites, erected 87 nest boxes, banded 811 owls, captured 197 adults, and radio-equipped 53 owls. Adult turnover among nest sites and between years was high. Nest box use increased from 30% of all nests in 1981 to 72% in 1985, yet we observed no increase in the nesting population. Nest site use and annual productivity were related to grassland and meadow vole (Microtus pennsylvanicus) availability. Owls ranged up to 5.6 km from nests to forage specifically in grasslands and took voles over alternative small mammals more often than by chance alone. The r-selected nature of the Barn Owl allows it to quickly increase when adequate foraging habitat and energy resources (selected prey) are available. Agricultural changes in Ohio have resulted in loss of Barn Owl foraging habitat; owl population changes were highly correlated with that change.

Barred Owl (Strix varia) nesting and behavior in northwestern Connecticut.

PETER DeSIMONE (National Audubon Society, P.O. Box 824, Trabuco Canyon, California 92678), Michael Root (Johnson Road, Cornwall, Connecticut 06753) and Daniel Roddy (Route 14 Box 334A, Richmond, Virginia 23231).

Fifty-nine Barred Owl nesting attempts were studied in northwestern Connecticut between 1977 and 1985. Data were collected on weights and measurements of fifty young owls when banded. Growth rate data were also collected on two broods of owls every second day from hatching to fledging. Behavioral documentation consisted of 200 hours of nighttime blind work at one nest and numerous opportunistic daytime observations at all nests and territories. Vocalizations were recorded and related to corresponding behavior.

Feeding habits of the Burrowing Owl Athene cunicularia grallaria, in Campinas, State of São Paulo, Brazil.

VANDER S. DIAS (Instituto de Biologia, CP 6109, UNICAMP 13.100, Campinas, São Paulo, Brazil).

Data on feeding habits of the Burrowing Owl in South America are scant. A sample of 520 pellets was collected from 18 nests at 5 cattle fields in the region of Campinas (22°53'21"S and 47°04'39"W). From 2,038 food items sampled, 1,925 (94.5%) were arthropods and 113 (5.5%) were vertebrates. Insects represented 98.6% of the arthropods distributed as 1,509 (78.4%) Coleoptera; 251 (13%) Hymenoptera; 44 (2.3%) Orthoptera; 24 (1.6%) Blataria; 1 (0.05%) Lepidoptera; and 69 (3.6%) unidentified insects. The remaining arthropods were 24 (1.3%) Diplopoda and 3 (0.2%) Arachnids. Mammals represented 76.1% of the total vertebrate prey (85 Rodentia and 1 Marsupialia). The other vertebrates included 15 (13.3%) Aves, 10 (8.9%) Amphibians (Anura), and 2 (1.8%) Reptilia (Serpentes). This study is still in progress.

Behavioral and physical development of Barred Owls, Strix varia.

THOMAS C. DUNSTAN and Thomas E.M. Varchmin (Department of Biological Sciences, Western Illinois University, Macomb, Illinois 61455. Phone: 309-298-1546).

The behavioral and physical development of 22 nestling Barred Owls were studied in the oak-hickory riparian habitat of west central Illinois. Five stages of development were studied from hatching in early April to fledging in early May. A positive relationship existed between development of juvenal feathers and weight ($r = 0.82$; $S = 0.001$). Nestling behaviors toward human intruders appeared to be related to fear, but later developed into aggression. Nestlings climbed within the nest cavity at a very early age, gave peep and chitter calls, and showed little aggression toward siblings. Beak clapping, hissing, and food-begging calls developed after 11 days of age and continued after fledging.

Reproductive Biology of the Great Horned Owl (Bubo virginianus) in the desert of Mapimi, Durango, Mexico.

RICARDO R. ESTRELLA (Instituto de Ecología, Apdo. Postal 18-845, 11800 México, D.F.), Fernando Hiraldo (Museo Nacional de Ciencias Naturales, Castellana 80, 28046 Madrid, Spain), and Alfredo Ortega (Instituto de Ecología, Apdo. Postal 18-845, 11800 México, D.F.)

The Great Horned Owl is the most widely distributed owl species in North America. Though there are many studies concerning its reproduction, few Mexican studies have been reported. This study presents results on the reproductive events of a Great Horned Owl population at the Mapimi Biosphere Reserve (MAB-UNESCO Program) in the state of Durango, Mexico (26°29' to 26°52'N; 103°32' to 103°58'W). From March to July 1985 seven Great Horned Owl pairs were studied by nest observation with 10 x 40 binoculars and by analysis of pellets collected weekly at the nest and perch sites. Nests were localized in the roughest topographical portions of the area. Mean clutch size was 2.28 eggs per pair, and mean reproductive success was 1.77 young per pair. The Chihuahuan Raven (Corvus cryptoleucus) was the main predator of Great Horned Owl eggs in this desert. Young black-tailed jackrabbits (Lepus californicus), woodrats (Neotoma albigula), and snakes (Crotalus sp., Arizona sp.) were the main food carried to the nests by the parents. Between May and June young left the nests and began to hunt by themselves, although they stayed in the parents' territory until July. In general, our results agree with previous studies for other desert Great Horned Owl populations of North America. However, there are interesting differences in the timing of the reproductive events at Mapimi's desert population in comparison with populations of other deserts. This probably is in response to the cyclic abundance of prey in the area.

Breeding ecology of the Great Gray Owl (Strix nebulosa) in the Grand Teton region of Idaho and Wyoming.

ALAN FRANKLIN (Department of Wildlife, Humboldt State University, Arcata, California 95521. Phone: 707-443-1217).

A breeding population of Great Gray Owls was found in a little known portion of the range of this species. Evidence of 67 territories was found in southeastern Idaho and northwestern Wyoming. Between 1980 and

1983, 79% of the territories were known to be occupied, while 45% were known to be reproductively active. Nine of 15 nests found were in broken-top snags. Seventy-eight percent of the reproductively active nests were reused at least once. Nesting success and productivity were considered high. Snow depth apparently affected the onset of nesting as well as the use of wintering areas at lower elevations. Northern pocket gophers (Thomomys talpoides) and voles (Microtus sp.) constituted 93% of the prey. The proportion of these two species in the diet varied depending on the area sampled. Nesting habitat and management implications also will be discussed.

Distribution of Mexican Spotted Owls in Arizona.

JOSEPH L. GANEY and Russell P. Balda (Department of Biological Sciences, Northern Arizona University, Box 5640, Flagstaff, Arizona 86001. Phone: 602-774-1549 and 602-523-4307).

A study of the distribution, general biology, and abundance of Mexican Spotted Owls in Arizona is underway. Spotted Owls have been located throughout much of the state at elevations ranging from 5,000 to 9,400 feet in a variety of coniferous and mixed-deciduous habitat types. These habitat types will be discussed in more detail with emphasis on roosting habitat. Information will also be presented on food habits, movements, and general biology of Spotted Owls in Arizona.

Summer habitat and nest site selection of Elf Owls at Saguaro National Monument, Arizona.

M. SUSANNA GOAD (Arizona Cooperative Wildlife Research Unit, University of Arizona, Tucson, Arizona 85721. Presently at: U.S. Bureau of Land Management, 3150 Windsor, Yuma, Arizona 85365. Phone: 602-726-6300).

In the Sonoran Desert Elf Owls (Micrathene whitneyi) are secondary cavity nesters in Saguaro cactus (Cereus giganteus). Summer habitat of Elf Owls and nest site selection were examined at Saguaro National Monument, Rincon Mountain Unit, during 1983 and 1984. Elf Owls were censused by spot-mapping on nine 10-hectare plots. Owl density was compared to coverage of perennial plants by height class and Saguaro density by size class. Density of Elf Owls was positively correlated with the largest size class of Saguaros ($r = 0.64$, $p < 0.05$). Vegetation around nests ($n = 67$) was compared to vegetation around random sites ($n = 111$) within two major vegetation series. In both vegetation series, there were higher numbers of large Saguaros around nest sites than around random sites ($p < 0.05$). Nests in the mixed grass-mixed shrub series had a higher percent cover ($p < 0.01$) of perennial plants greater than 250 cm in height and thus a higher cover of all perennial plants ($p < 0.01$) than random sites. In both vegetation series, apparently, any Saguaro with a cavity was a potential Elf Owl nest site. (FIRST ALTERNATE IN CASE OF CANCELLATION.)

Flammulated Owl habitat use in northeast Oregon.

REBECCA GOGGANS (Department of Fisheries and Wildlife, Oregon State University, Corvallis, Oregon 97331. Phone: 503-754-4531) and E.C. Meslow (Oregon Cooperative Wildlife Research Unit, Oregon State University, Corvallis, Oregon 97331. Phone: 503-754-4531).

Flammulated Owl diet and habitat selection for nesting, roosting, and foraging were studied during 2 breeding seasons. Radio telemetry was used to monitor roosting and foraging by 5 male owls; remote photography to record prey deliveries to 5 nests; and window traps to sample relative abundances of prey between 3 habitats. Of 20 nests, 74% were in ponderosa pine-Douglas fir forests, and 76% were on sites with less than 50% canopy closure, although these habitats constituted only 50% and 22%, respectively, of the study area. Of 37 roosts, 54% were in mixed conifer forests, a habitat which is 32% of the combined home ranges. In roosts 17% of the trees were ponderosa pine, yet 67% of the roost trees were this species. Of 352 locations from foraging owls, 77% were in ponderosa pine, and 67% were in forest-edge. These habitats comprised 22% and 26%, respectively, of the home ranges. The diet spanned 8 Arthropod orders, but 72% was of the order Orthoptera. Seventy percent of the Arthropods and 90% of the Orthopterans trapped were in grasslands.

Current and future distribution and abundance of Spotted Owls in California.

GORDON I. GOULD, JR. (California Department of Fish and Game, 1416 Ninth Street, Sacramento, California 95814. Phone: 916-322-1263).

Currently I know of 1,456 different locations in 41 counties in California which have been occupied by Spotted Owls over the last 12 years. By evaluating the past survey coverage, I estimate that Spotted Owls now occupy 2,100 sites in the state. About 88% of the known sites are on National Forest lands, and about 80% are occupied by a pair of owls. The major land use of Spotted Owl habitat on both public and private lands is the production of saw-timber, an activity which eliminates owl habitat and is expected to continue reducing habitat over the next 50 years. National Forest personnel are now writing and implementing land-use plans to preserve 29-100% (depending on the Forest) of the known sites on their lands. Currently no state policy exists to preserve any sites on private forested lands. As a result of habitat loss, 1,200 sites are expected to be occupied 25 years from now; in 50 years Spotted Owls probably will exist at only 850 sites. Whether this population of Spotted Owls is large enough to maintain the species in California is now only a matter of speculation.

Dispersal ecology of juvenile Northern Spotted Owls (Strix occidentalis caurina) in northwestern California.

R.J. GUTIÉRREZ, J. Patrick Ward, Jr., Alan B. Franklin, and William LaHaye (Department of Wildlife, Humboldt State University, Arcata, California 95521. Phone: 707-826-3320).

Twenty-nine juvenile Northern Spotted Owls were captured in 1983 and 1984 and outfitted with radio transmitters. Owlets were relatively sedentary prior to dispersal. There was no statistical correlation between predispersal activity and dispersal pattern. Dispersal began in late

September. We observed significant differences between the pattern of dispersal of the 1983 and 1984 cohorts. The 1983 cohort traveled more quickly (\bar{x} = 8.01 km/day) than the 1984 cohort (\bar{x} = 4.8 km/day) and dispersed further (1983, \bar{x} = 45.3 km; 1984, \bar{x} = 16.4 km). The two cohorts differed significantly in the direction they dispersed (1983, \bar{x} = 154°; 1984, \bar{x} = 210°). In 1983 the entire cohort's movement showed a direction significantly different from a random distribution. However, the 1984 cohort showed a dispersal direction that was not significantly different from random. Initial dispersal direction did not appear to be affected by topographic features. No sex biased dispersal was observed.

Continued range expansion of the Barred Owl (Strix varia) in western North America from 1976-1985.

TOM HAMER (U.S.D.A. Forest Service, Mt. Baker Ranger District, 2105 Highway 20, Sedro Woolley, Washington 98282. Phone: 206-856-5700) and Harriet L. Allen (Washington Department of Game, 708 40th St., N.W., Marysville, Washington 98270. Phone: 206-653-8290).

The Barred Owl was documented in 1976 to be expanding its range into the northwestern United States and southern British Columbia. We determined the current distribution by compiling records for the period 1976-1985. Sightings were obtained from published records, agency files, and by consulting biologists in states and provinces throughout the northwest. In 1976 there were only 22 records of Barred Owls in the Pacific Northwest region. We compiled more than 200 additional records for the 1976-1985 period. By 1985 Barred Owls had extended their range as far south as northern California and as far north as southeast Alaska. They are now considered common in southern British Columbia, northern Idaho, and northeastern Washington.

The breeding ecology of Burrowing Owls in Saskatchewan.

ELIZABETH HAUG (Department of Veterinary Anatomy, University of Saskatchewan, Saskatoon, Saskatchewan S7N 0W0 Canada. Phone: 306-966-7417).

The breeding ecology of Burrowing Owls (Athene cunicularia) was studied in central Saskatchewan during 1982 and 1983. Home range, activity patterns, and foraging habitat utilization were determined with the aid of radio-telemetry. Six adult male owls were monitored during the peak foraging periods. Owls selected grass/forb areas and avoided crop and native pasture in comparison to their occurrence within the home ranges. Average home range size was 2.41 km² and ranged from 0.14 to 4.81 km². Activity patterns were monitored; peak foraging hours occurred with long distance flights between 1900 and 0630 hours. Information was collected on breeding phenology, nest success and production, burrow use, mortality and nest failures, and food habits. Management implications and recommendations are discussed.

Resource partitioning among forest owls: preliminary evidence for the importance of habitat segregation.

GREGORY D. HAYWARD and Edward O. Garton (Department of Wildlife Research, University of Idaho, Moscow, Idaho 83843. Phone: 208-885-6434).

We located Saw-whet, Great Horned, Screech, Boreal, Pygmy, Flammulated, and Long-eared Owls in a central Idaho wilderness area. The owl species coexisted through differential use of three basic resources--space, food, and time. Screech owls used only low elevation riparian habitats. Boreal and Flammulated Owls inhabited higher life zones associated with mature coniferous habitats. Multiple stepwise discriminate function analysis identified three gradients of forest structure which distinguished calling sites of Saw-whet/Boreal, Saw-whet/Screech, and Great Horned/Screech Owl pairs, correctly classifying 70% of 84 owl singing sites. Diets of Saw-whet, Screech, and Boreal Owls overlapped considerably. Pygmy and Flammulated Owl diets differ from the small mammal predators; the Flammulated Owl is an insectivore, and Pygmy Owls consume a varied diet. The Pygmy Owl niche differs also in activity period, being largely diurnal.

A selective review of food-niche relationships among Nearctic, Palearctic, and Neotropical Owls.

FABIAN M. JAKSIC (Departamento de Biología Ambiental, Universidad Católica de Chile, Casilla 114-D, Santiago, Chile. Phone: 222-4516 ext. 2614).

I studied food-niche relationships among owls at levels of resolution ranging from entire predator assemblages to local populations. I show that the trophic-guild structure of owl assemblages changes geographically, that potentially competing owls vary in number and identity, and that owl trophic guilds usually include hawks, sometimes mammalian carnivores, and snakes. Analysis of the trophic ecology of local populations of Athene, Tyto, and Bubo owls living in Chile, Spain, and California shows that diet breadths and mean prey sizes taken differ widely and inconsistently across regions. Apparently, the varying characteristics of the trophic/guild structure of owl assemblages emerge from the opportunistic behavior of local owl populations with regard to the profiles of prey sizes and local availability.

Biology and status of the Burrowing Owl (Athene cunicularia) on the campus of the University of California, Davis.

BRENDA S. JOHNSON (Department of Zoology, University of California, Davis, California 95616. Phone: 916-752-2938) and Terry A. Schulz (University of California Davis Raptor Center, Davis, California 95616. Phone: 916-752-6091).

Nesting sites on the Davis campus are in close proximity to human activity. It is not known whether this is a phenomenon of habituation or limited habitat availability. Nesting habitat has steadily diminished due to development on campus. Artificial burrows and perches and low-cut grass have been successful management techniques. Observations of the nesting cycle, feeding behavior, post-fledging movements, and use of satellite burrows by members of different broods are discussed. The

highest mortality in young is due to collisions with vehicles and predation by feral cats. The diet corresponds with the availability of prey and consists mainly of grasshoppers (Orthoptera) which are in great abundance in the foraging and nesting territory when the young are developing.

Differentiation and relationships of the West Peruvian Screech-Owl (Otus roboratus).

NED K. JOHNSON and Robert E. Jones (Museum of Vertebrate Zoology, University of California, Berkeley, California 94720. Phone: 415-642-3567).

Analysis of vocalizations of the dwarf form of the Screech Owl from northwestern coastal Peru establishes conspecificity with Otus roboratus of the mid-Maranon Valley. Otus roboratus previously was considered to be monotypic. The vocal evidence from both forms of roboratus does not support Hekstra's opinion that O. r. pacificus is a race of O. guatemalae or that O. r. roboratus is a race of Otus choliba. The coastal form pacificus differs significantly from the nominate form of roboratus in a series of characters of both size and color; some features do not overlap. Both forms of Otus roboratus are polymorphic in color, with brown and red phases represented. This example of striking differentiation adds to the substantial list of endemic forms of birds already known from northwestern Peru.

Man-Owl: a superstitious concept.

T. SURESH KUMAR, Raptor Research Centre, 7-1, Chaitanyapuri P.O. P & T Colony, Hyderabad 500 660, India.

An extensive survey was made on various socioeconomic aspects of owls. The results of this survey have shown that many people in this area believe strongly the superstitions attached to the owls. Many owl species are being used for treating various ailments (nervous debility, body pain, sexual weakness, etc.), Jadumantras, Talisman, and occultism where owls are being used as apparent ceremonial subjects. Because of this, many owls (especially Barn Owls (Tyto alba), Great Horned Owls (Bubo bubo), and Spotted Owlets (Athene brama)) are rapidly decreasing in numbers in this region. There is heavy demand for these owls in many bird markets. In this study, some interesting references have been given from older manuscripts where the owl was the subject of particular scenes. Further, conservation measures have been outlined.

The use of playback response to census Spotted Owls (Strix occidentalis): a test of validity.

STEPHEN A. LAYMON (Department of Forestry and Resource Management, 145 Mulford Hall, University of California, Berkeley, California 94720).

Eight Spotted Owls, 3 males and 5 females, equipped with radio transmitters were located on 235 occasions and were then exposed to playback of 10, 4-hoot calls. Overall response rate was 25%. Statistically significant differences were observed for: 1) individual owl; 2) sex of owl, with males responding more frequently; 3) breeding status, with nonbreeders

responding more frequently; and 4) month of year, with response in August being higher than either July or September. No statistically significant effect was detected for moon phase. Management implications of censusing Spotted Owls and determining locations of Spotted Owl management areas using the vocal response method are discussed.

Breeding biology of Flammulated Owls (*Otus flammeolus*).

BRIAN D. LINKHART and Richard T. Reynolds (Rocky Mountain Forest and Range Experiment Station, 240 W. Prospect, Ft. Collins, Colorado 80526-2098. Phone: 303-224-1275).

The breeding biology of Flammulated Owls was studied in montane forests in central Colorado from 1980-1985. Eggs were laid in early June, and incubation required 21-22 nights. Mean clutch size was 2.8 eggs ($n = 10$, $SD = 0.42$, range = 2-3). Females incubated and brooded, while males were the sole providers of food until late in the nestling period. Males captured mostly small moths. On a nightly basis, the frequency with which males delivered food to the nest was highest immediately after dark, and on a seasonal basis, the nightly deliveries were nearly three times higher after hatching than during incubation. Nests produced a mean of 2.6 young per brood ($n = 19$, $SD = 0.61$, range = 1-3). Young fledged by late July, 22-25 nights after hatching. Broods divided at fledging, with one brood segment attended by the male and the other by the female. By 24-30 nights after fledging, adults no longer provisioned the young with food. Young dispersed from the study area by late August, and adults left by mid-October.

Management and assessment of Northern Spotted Owl populations on National Forests in Washington and Oregon.

BRUCE G. MARCOT and R.S. Holthausen (U.S.D.A. Forest Service, Pacific Northwest Region, 319 Southwest Pine Street, Portland, Oregon 97208. Phone: 503-221-3464) and Fred B. Samson and Andrew B. Carey (U.S.D.A. Forest Service, Pacific Northwest Range and Forest Research Station, 3625 93rd Avenue, S.W., Olympia, Washington 98502. Phone: 206-753-9494).

The history of concern over the Spotted Owl and U.S.D.A. Forest Service concern reflect increasing awareness of the effects of landscape patterns and a growing data base on the owl. Recent publications and legal actions indicate a need for reanalysis of information about the Spotted Owl. That reanalysis must view existing natural history and population information within a framework that recognizes the demographic and genetic effects of different habitat patterns. It will be the basis for a supplemental Environmental Impact Statement on Spotted Owl management to be prepared by the Pacific Northwest Region of the Forest Service. The analysis will draw upon recent research and will likely highlight the need for improved information on several aspects of Spotted Owl natural history, genetics, and population dynamics.

Nest site characteristics and reproductive success of Long-eared Owls (Asio otus) in southwestern Idaho.

JEFFREY S. MARKS (U.S. Bureau of Land Management, 3948 Development Avenue, Boise, Idaho 83705. Phone: 208-334-1582).

One hundred and twelve nesting attempts were recorded for 104 owl pairs in the Snake River Birds of Prey Area in 1980 and 1981. All nests were in trees in old stick nests built by corvids. Discriminate function analysis identified nest diameter and nest height as the variables that best distinguished owl nests from unused, apparently suitable corvid nests. Using nests found during incubation, nesting success was 34% in 1980 and 51% in 1981, with a minimum of 3.4 and 4.0 young fledged per successful nest. Most nesting failures were caused by predation. Unsuccessful nests tended to be closer to water and thus more accessible to raccoons than were successful nests. Young owls left the nest about 2 weeks before they could fly to "branch" in the tree canopy near the nest. Branchers had high survival, and branching probably evolved to reduce nest predation. The number of nesting pairs in the study area declined 35% from 1980 to 1981. Nesting sites were most likely to be reoccupied in 1981 if they had been successful in 1980.

The current status of the Burrowing Owl in Minnesota.

MARK S. MARTELL (Raptor Research and Rehabilitation Program, University of Minnesota, St. Paul, Minnesota 55108. Phone: 612-376-5642), John Schladweiler (Minnesota Department of Natural Resources Nongame Program, Box 756, New Ulm, Minnesota 56073. Phone: 507-354-2196), Patrick T. Redig, William Lane, and Gary E. Duke (Raptor Research and Rehabilitation Program, University of Minnesota, St. Paul, Minnesota 55108. Phone 612-376-5642).

The Burrowing Owl (Athene cunicularia) was first noted as part of Minnesota's breeding avifauna by Roberts in 1881. He considered it a common resident by 1936 and noted the eastward expansion of its range. By the mid-1960's however, less than 20 breeding pair were found by Grant. There are only a few records of breeding birds during the 1970's and 1980's. Cultivation of native prairie and grazing land, shooting, and decimation of burrowing mammalian species are probably the main reasons for the species' decline. A survey in the spring of 1985 determined that there is considerable available habitat within protected areas. Therefore, in August 1985 a reintroduction of Burrowing Owls was undertaken at Blue Mound State Park in southwestern Minnesota.

The Barn Owl (Tyto alba)--what do we know about it?

CARL D. MARTI (Department of Zoology, Weber State College, Ogden, Utah 84408. Phone: 801-626-6172).

The Barn Owl is the most widespread and one of the best known owls. Despite the tremendous amount of literature on the species, there are major gaps in what we know about its biology. Nothing more than natural history notes are available for most of the 35+ races. To understand the great plasticity in reproduction and feeding exhibited by Barn Owls, large samples gathered over long time-periods are needed. Most published data do not meet these requirements. Food habits data are available for only 13 races (mostly from 3), and adequate reproductive data have been

Best also characterized and reproductive success of long-eared Owl
(*Bubo auritus*) in southwestern Idaho.
JERRY E. HARRIS (B.S. Degree of Land Management, 1968, Washington
State University, Pullman, Idaho 99164. Phone: 509-685-1587.)
One hundred and twenty nesting attempts were recorded for 106 owl pairs
in the Snake River Birds of Prey Area in 1980 and 1981. All nests were in
trees in the riparian zone built by cowbirds. Discriminate function analysis
indicated nest success and nest height as the variables that best dis-
tinguished owl nests from cowbird nests. Nest success was 38% in 1980 and 51% in
1981, with a minimum of 1.5 and 4.0 years fledged per successful nest.
Nest success was caused by predation. Unsuccessful nests tended
to be closer to water and trees were accessible to raptors than were
successful nests. Young were lost the nest about 2 weeks before they
could fly to "branch" in the first half of the nest. Branching had
high survival, and nestling probably arrived to reduce nest predation.
The number of nesting pairs in the study area declined 35% from 1980 to
1981. Nesting pairs were most likely to be resighted in 1981 if they had
been successful in 1980.

The current status of the Burrowing Owl in Minnesota.
MARK S. HARTILL (Robert Research and Rehabilitation Program, University
of Minnesota, St. Paul, Minnesota 55108. Phone: 612-515-1881. John
Schubert, Minnesota Department of Natural Resources, Hennepin County
Box 750, New Rich, Minnesota 55071. Phone: 507-324-7100. Patrick T. Haggis,
William Lake, and Gary E. Duke (Robert Research and Rehabilitation Program,
University of Minnesota, St. Paul, Minnesota 55108. Phone 612-515-2647).
The Burrowing Owl (*Athene cunicularia*) was first noted as part of
Minnesota's breeding avifauna by Roberts in 1881. He considered it a
common resident by 1930 and noted the eastward expansion of its range. By
the mid-1960's however, less than 50 breeding pairs were found by Grant.
There are only a few records of breeding birds during the 1970's and
1980's. Collection of native prairie and grazing land, shooting, and
disturbance of burrowing mammalian species are probably the main reasons
for the species' decline. A survey in the spring of 1985 determined that
there is considerable available habitat within protected areas. Therefore,
in August 1985 a reintroduction of Burrowing Owls was undertaken at the
Mound State Park in southeastern Minnesota.

The Barn Owl (*Tyto alba*) - what do we know about it?
CARL S. HARTILL (Department of Ecology, Weber State College, Ogden, Utah
84408. Phone: 801-824-6171).
The Barn Owl is the most widespread and one of the best known owls.
Despite the tremendous amount of literature on the species, there are
major gaps in what we know about its biology. Nothing more than natural
history notes are available for most of the 35+ races. To understand the
great plasticity in reproduction and feeding exhibited by Barn Owls, large
samples gathered over long time periods are needed. Most published data
do not meet these requirements. Good habitat data are available for only
11 races (mostly from U.S.) and adequate reproductive data have been

collected from only 4. Considerable size variation occurs among the widespread races (up to 2X in body weight). Barn Owls are specialists in feeding on small mammals, but opportunistically take many species. Barn Owls seem able to exploit new resources rapidly (prey and nest sites) and fall into the r-selected end of the reproductive spectrum compared to other raptors. Barn Owls have shown significant population and distribution changes--both declines and expansions--in this century.

The breeding behavior of injured and imprinted owls in captivity.

KATHERINE MCKEEVER (The Owl Rehabilitation Research Foundation, R.R. No. 1, Vineland Station, Ontario, Canada LOR 2E0. Phone: 416-562-5986).

Wild, damaged owls will reproduce in captivity given time, space, and choices in critical psychological matters. This brief visual account concerns nine species of native North American owls from both Canada and the United States, received as permanently damaged wild adults, which have reproduced at the Vineland facility during the past decade. Included are: Snowy, Great Horned, Great Gray, Barn, Screech, Burrowing, Boreal, Saw-whet, and Pygmy Owls. The slides also demonstrate the use of foster parent owls, both wild birds and human imprints, in providing psychological security and species recognition for orphaned nestlings.

Observations on captive breeding behavior of permanently injured Great Gray Owls (Strix nebulosa).

KATHERINE MCKEEVER (The Owl Rehabilitation Research Foundation, R.R. No. 1 Vineland Station, Ontario, Canada LOR 2E0. Phone: 416-562-5986).

Both parent owls were admitted with fresh injuries in 1977. They were housed as other pairs until 1982 when they were introduced in a 1,000-sq. ft. compound already familiar to the female. A second male, added in September 1984 to provide competition, was removed at the onset of egg laying in April 1985 when dominance was demonstrated by the first male. Three fertile eggs were incubated to full term by the female, but an unidentified nest disturbance caused the disappearance of the first chick at about 48 hours, the crushing of the second egg during hatch, and the abandonment of the third egg, already pipped. This egg was warmed in an incubator and hand hatched at 64 hours. The chick was then brooded and fed by a human imprint Spectacled Owl and was returned to its parents' nest before visual focus began. Although the owlet slowly achieved species orientation, its food cries were largely ignored by its parents, and it was fed surreptitiously by human hand until it left the nest and took mice itself. A comparison is drawn between this surprising lack of parental care by successfully breeding Great Grays, and the assiduous care given all foster nestlings by a captive pair of Barred Owls (Strix varia) unable to breed due to physical damage sustained by the male.

collected from only 2. Considerable size variation occurs among the
 without races (up to 12 in body weight). Bare Ovis and specialists in
 feeding on small mammals, but occasionally take many species. Bare
 Ovis seem able to withstand low temperatures (grey and black) and
 fall into the 2-mountain and of the reproductive spectrum compared to
 other regions. Bare Ovis show significant population and distribu-
 tion changes--both declines and expansions--in this century.

The breeding behavior of injured and orphaned ovis in captivity.
 KATHERINE MONTGOMERY (The Owl Rehabilitation Research Foundation, R.R.
 No. 1, Vineland Station, Ontario, Canada L0R 2Y0. Phone: 515-363-3585).
 Wild, domestic ovis will reproduce in captivity given time, space, and
 choice in natural psychological habitats. This belief stems from
 concerns about species of native North American ovis from both Canada and
 the United States, recorded as persistently damaged wild adults, which have
 reproduced at the Vineland facility during the past decade. Included
 are: Rocky, Green Horned, Great Grey, Fawn, Blackish, Burrowing, Horned,
 Sambar, and Pygmy Ovis. The ovis also demonstrate the use of foster
 parent ovis, both wild and human infants, in providing psychological
 security and species recognition for orphaned nestlings.

Observations on captive breeding behavior of experimentally injured Great
 Grey Ovis (*Ovis montanus*).
 KATHERINE MONTGOMERY (The Owl Rehabilitation Research Foundation, R.R.
 No. 1, Vineland Station, Ontario, Canada L0R 2Y0. Phone: 515-363-3585).
 Both parent ovis were admitted with fresh injuries in 1977. They were
 housed as other pairs until 1982 when they were introduced to a 1,500-sq.
 ft. compound already familiar to the female. A second male, added in
 September 1984 to provide competition, was removed at the onset of the
 laying in April 1985 when dominance was demonstrated by the first male.
 Three fertile eggs were incubated to full term by the female, but an
 unhatched nestling caused the disappearance of the first chick
 at about 48 hours, the opening of the second egg during hatch, and the
 abandonment of the third egg, already piped. This egg was warmed in an
 incubator and hand hatched at 64 hours. The chick was then bonded and
 fed by a human infant Spontaneous Owl and was returned to its parents.
 Next before visual focus began. Although the ovis already exhibited
 species orientation, the food crisis was largely ignored by its parents,
 and it was fed correspondingly by human hand until it left the nest and
 took mice itself. A competition is shown between this surprising lack of
 parental care by experimentally breeding Great Grey, and the excellent care
 given all foster nestlings by a native pair of Barred Ovis (*Ovis montanus*)
 unable to breed due to physical damage sustained by the male.

Elf Owls (Micathene whitneyi): their potential for population management in California.

GAIL I. NAYLOR (The Peregrine Fund/Predatory Bird Research Group, Lower Quarry, University of California, Santa Cruz, California 95064. Phone: 408-429-2466), and Brian J. Walton (address same as above).

The Elf Owl has been listed as an endangered species in California. Elsewhere in its range it is locally common and has been studied more intensively, largely by Ligon. We were interested in applying techniques that had been developed for Peregrine Falcons to this very small and nocturnal species of owl in an effort to facilitate a population increase along the Colorado River between California and Arizona. Recent surveys have determined this species to be nearly extinct in this region. Small young were collected from a healthy population in Arizona for captive breeding stock in 1983. Chambers were constructed based on designs by McKeever for owls and The Peregrine Fund for falcons. Feeding regimes, food base, incubation techniques, and release techniques are being developed. Sexing of breeders, natural copulation of all captive pairs, fostering of young, and other breeding efforts have been successful. First releases from an experimental design release structure were made in 1985.

Habitat utilization, movements, and roost site selection of Boreal Owls (Aegolius funereus) in Colorado.

DAVID A. PALMER and Ronald A. Ryder (Department of Fisheries and Wildlife Biology, Colorado State University, Fort Collins, Colorado 80523. Phone: 303-493-1748 and 303-491-6547).

Macrohabitat selection was analyzed for 21 territorial male Boreal Owls during 1983 and 1984 in Larimer County, Colorado. The owls selected primarily mature spruce-fir (Picea engelmanni-Abies lasiocarpa) forests interspersed with numerous subalpine meadows, while avoiding large unbroken tracts of forest and lodgepole pine (Pinus contorta) and aspen (Populus tremuloides) stands. Three Boreal Owls were radio marked and followed from May 1984 through January 1985. Home range size increased from 3 square km during the breeding season to over 11 square km in the fall and winter. Daily movements between roosts ranged from 15 m to 6.9 km and averaged over 700 m. Seven of 14 habitat variables collected from 152 roost sites were significantly different than data gathered at random sites.

Pair bonding and site tenacity in Flammulated Owls (Otus flammeolus).

RICHARD T. REYNOLDS and Brian D. Linkhart (Rocky Mountain Forest and Range Experiment Station, 240 W. Prospect, Fort Collins, Colorado 80526-2098. Phone: 303-224-1267).

The pair bonding and site tenacity of a marked population of breeding Flammulated Owls were studied in central Colorado from 1980-1985. Four to six nesting attempts occurred in each of five years on a 452-ha area. In the spring, returning males arrived on the study tract first and always reoccupied their previous territories. Returning females arrived later and settled into their previous year's territories, provided that the territories were occupied by males. If not, then females moved into territories of neighboring, unpaired males. Some individual owls remained paired up to 3 years, but this occurred only when males continuously

Elk Ovis (*Oreamnos americanus*): Their potential for population management in California.

GAIL T. MAYLOR (The Peregrine Fund/Peregrine Bird Research Group, Lower Mersey, University of California, Santa Cruz, California 95064. Phone: 408-452-1202), and Brian J. Walton (address same as above).

The Elk Ovis has been listed as an endangered species in California. Elsewhere in its range it is locally common and has been studied more intensively, largely by Maylor. We were interested in applying techniques that had been developed for Peregrine Falcons to this very small and nocturnal species of cat in an effort to facilitate a population increase along the Colorado River between California and Arizona. Recent surveys have determined this species to be nearly extinct in this region. Small young were collected from a nearby population in Arizona for captive breeding about in 1983. Chambers were constructed based on designs by Maylor for owls and the Peregrine Fund for falcons. Feeding regimes, food bases, incubation techniques, and release techniques are being developed. Testing of procedures, natural acquisition of all captive pairs, lowering of young, and other breeding efforts have been successful. First releases from an experimental design release structure were made in 1985.

Habitat utilization, movements, and roost site selection of Horned Ovis (*Oreamnos montanus*) in Colorado.

DAVID A. FALLEN and Ronald A. Nyder (Department of Fisheries and Wildlife Biology, Colorado State University, Fort Collins, Colorado 80523. Phone: 303-438-1788 and 303-491-6247).

Macrohabitat utilization was analyzed for 21 territorial male Horned Ovis during 1983 and 1984 in Larimer County, Colorado. The ovis selected primarily riparian areas for (*Picea canadensis*-*Abies balsamea*) forests interspersed with mountain meadows, while avoiding large meadows. Forest of forest was (*Pinus contorta*) and aspen (*Populus tremuloides*) stands. Three Horned Ovis were radio marked and followed from May 1984 through January 1985. Home range size increased from 3 square km during the breeding season to over 11 square km in the fall and winter. Daily movements between roosts ranged from 12 m to 6.9 km and averaged over 700 m. Seven of 14 habitat variables collected from 152 roost sites were significantly different than data gathered at random sites.

Habitat use and site tenacity in Flammulated Ovis (*Oreamnos montanus*).

RICHARD T. KETNER and Brian E. Linkhart (Rocky Mountain Forest and Range Experiment Station, 250 W. Prospect, Fort Collins, Colorado 80526-5008. Phone: 303-624-1267).

The pair bonding and site tenacity of a marked population of breeding Flammulated Ovis were studied in central Colorado from 1980-1982. Four to six nesting attempts occurred in each of five years on a 452-ha area. In the spring, returning males arrived on the study first and always accompanied their previous territories. Returning females arrived later and settled into their previous year's territories, provided that the territories were occupied by males. If not, then females moved into territories of neighboring, unpaired males. Some individual ovis remained paired up to 3 years, but this occurred only when males continuously

reoccupied their territories. Some females, each of which had lost their previous year's male, nested in 2 to 3 different territories during the study. Evidence suggests that there is competition among males for suitable territories and, after females arrive, competition among females for established territorial males.

Habitat and nest site selection by Burrowing Owls in the sagebrush steppe of Idaho.

TERRELL RICH (U.S. Bureau of Land Management, P.O. Box 1229, Dickinson, North Dakota 58602. Phone: 701-225-9148).

The local topography and vegetation around 127 occupied Burrowing Owl (Athene cunicularia) nest sites in the sagebrush steppe of southcentral Idaho were quantified and compared with data from 80 randomly chosen sites. Owls used burrows provided by badgers (Taxidea taxus) in open soil and by marmots (Marmota flaviventris) in small lava outcrops. The latter were chosen and re-used more often. In comparison to randomly chosen sites, occupied sites had a greater cover of wheatgrass (Bromus tectorum), had a greater habitat diversity, were lower in elevation, and were more often placed on southerly aspects. Discriminate function analysis classified 78.7% of occupied sites, but only 62.5% of randomly chosen sites, correctly. Burrow security and prey availability, especially the proximity to populations of Microtus montanus on agricultural land, may explain some of the habitat selection observed.

Status of the Boreal Owl (Aegolius funereus) in Colorado.

RONALD A. RYDER and David A. Palmer (Department of Fisheries and Wildlife Biology, Colorado State University, Fort Collins, Colorado 80523. Phone: 303-491-6547 and 303-493-1748) and John J. Rawinski (U.S.D.A. Forest Service, Rio Grande National Forest, Monte Vista, Colorado 81144. Phone: 303-852-5941).

Specimens and observations (published and unpublished) indicate that Boreal Owls have been known in Colorado for over 80 years. Although formerly listed as only a rare winter visitor, the species has probably been a resident since the Pleistocene. Since 1979, intensive searches for nesting Boreal Owls have been centered near Cameron Pass in northern Larimer County where 4 nestings have been documented. Breeding season observations of Boreal Owls believed to be territorial have been made in at least 9 other counties. The species seems to be rather widely distributed, mainly above 2,900 m, in climax spruce-fir (Picea engelmannii-Abies lasiocarpa) forests as far south as Wolf Creek Pass, only 80 km north of the New Mexico border. Occurrence of calling male owls seems to vary widely, probably dependent on the abundance of small rodents.

reoccupied their territories. Some females, each of which had lost their previous year's mate, mated in 1 to 3 different territories during the study. Evidence suggests that there is competition among males for suitable territories and, after females arrive, competition among females for established territorial mates.

Radial and nest site selection by Burrowing Owl in the sagebrush steppe of Idaho.

THOMAS RICH JR., Bureau of Land Management, P.O. Box 1225, Dickinson, North Dakota 58601. (Phone: 701-482-4182)

The local topography and vegetation around 117 occupied Burrowing Owl (*Chordeiles lunifrons*) nests sites in the sagebrush steppe of southeastern Idaho were quantified and compared with data from 50 randomly chosen sites. Owl nest locations provided by hunters (*Sceloporus* spp.) in open soil and by mammals (*Peromyscus leucopus*) in small shrub outcrops. The latter were chosen and re-used more often. In comparison to randomly chosen sites, occupied sites had a greater cover of *Artemisia tridentata* (*Bromus tectorum*), were lower in elevation, and were more often placed on southerly aspects. Unpublished function analysis of radial and nest site selection, but only 51.7% of randomly chosen sites, were available, and prey availability, especially the proximity to populations of *Microtus montanus* on agricultural land, may explain some of the radial selection observed.

Status of the Forest Owl (*Asio flammeus*) in Colorado.
 RONALD A. EMMETT and David A. Palmer (Department of Fisheries and Wildlife Biology, Colorado State University, Fort Collins, Colorado 80523).
 Phone: 970-481-4182 and 970-481-1788; and John J. Sawinski (U.S.D.A. Forest Service, Rio Grande National Forest, Montezuma, Colorado 81401).
 Phone: 970-481-3411

Research and observations (published and unpublished) indicate that Forest Owls have been known in Colorado for over 80 years. Although formerly listed as rare winter visitors, the species has probably been a resident since the 1930s. Since 1979, intensive searches for nesting Forest Owls have been conducted near Canon Pass in northern Larimer County where 4 nestings have been documented. Breeding season observations of Forest Owls believed to be territorial have been made in at least 2 other counties. The species seems to be rather widely distributed, mainly above 2,500 m, in climax spruce-fir (*Picea mariana*-*Abies lasiocarpa*) forests as far south as Wolf Creek Pass, only 50 km north of the New Mexico border. Occurrence of calling male owls seems to vary widely, probably dependent on the abundance of small rodents.

Ecology and management of the Common Barn Owl (Tyto alba) in the California Central Valley.

TERRY A. SCHULZ and Don Yasuda (University of California Davis Raptor Center, Davis, California 95616. Phone: 916-752-6091).

Natural nest sites and old barns have decreased in the Central Valley in the last 10 years. The main limiting factor for the Barn Owl appears to be nest site availability. Nesting success is correlated with the quality of the nest site. Nest boxes have increased the known nesting pairs in Davis by 100%. The first year after installation, 19% of the nest boxes were occupied; 70% were occupied by the fifth year. Average clutch size was 6 eggs with 72% hatching success. Fledging success was 73%. Of the pairs in nest boxes, 56% had two clutches. Most nests were initiated in April (21.5%) and August (15%). High mortality due to collisions along highways is correlated with fledging season and agricultural activity.

Construction of artificial Great Gray Owl (Strix nebulosa) nests.

RANDALL A. SMITH (U.S.D.A. Forest Service, Stanislaus National Forest, Groveland Ranger District, P.O. Box 709, Groveland, California 95321. Phone: 209-962-7825).

In September of 1984 ten artificial nest structures were installed in the vicinity of the Ackerson Meadow Complex on the Groveland Ranger District of the Stanislaus National Forest. These structures were created by topping large conifer trees (mostly incense-cedar, 30 to 55 inches DBH) and carving a nest bowl, including a water drain hole. The nest bowl was filled with decaying log debris to provide nest litter. In mid-April one of the structures was occupied by a Great Gray Owl, and two chicks hatched. One chick survived to fledge.

Habitat management for Spotted Owls (Strix occidentalis).

DAVID M. SOLIS (U.S.D.A. Forest Service, Six Rivers National Forest, 507 F Street, Eureka, California 95501. Phone: 707-442-1721), Patricia N. Manley (Humboldt State University, Arcata, California 95521. Phone: 707-826-3467), and George Lottritz (U.S.D.A. Forest Service, Six Rivers National Forest, 507 F Street, Eureka, California 95501. Phone: 707-442-1721).

Research was conducted to determine habitat use for 10 Spotted Owls (Strix occidentalis) in northwestern California. Information provided by radio-telemetry and habitat measurements was used to determine key habitat characteristics which need to be considered when managing habitat for Spotted Owls. Habitat management for Spotted owls may include the development of timber management prescriptions. Objectives of silvicultural prescriptions are to create or maintain characteristics of habitats intensively used by Spotted Owls for foraging, roosting, and nesting. Key habitat characteristics included a multi-layered stand structure, decadence, and a dense canopy. The effects of a variety of silvicultural options on the suitability of habitat for foraging, roosting, and nesting by owls are discussed; mitigation measures are suggested. Optimal prescriptions include retention of large (240+ years) trees and creation or retention of roost and nest groves, dead and down components, and large snags.

Ecology and management of the Common Raven (*Corvus corax*) in the California Central Valley.

THOMAS A. SCHULTZ and DON TOWNSEND, University of California Davis Campus Center, Davis, California 95616. Phone: 452-5000.

Natural nest sites and old barns have been used in the Central Valley in the last 10 years. The main limiting factor for the Raven Owl appears to be nest site availability. Nesting success is correlated with the quality of the nest site. Nest boxes have increased the known nesting pairs in Davis by 100%. The first year after installation, 10% of the nest boxes were occupied; 70% were occupied by the fifth year. Average clutch size was 5 eggs with 10% hatching success. Nesting success was 75%. Of the pairs in nest boxes, 50% had two chicks. Most nests were initiated in April (41.3%) and August (12.5%). High mortality due to collision along highways is correlated with fledging season and agricultural activity.

Construction of artificial Great Gray Owl (*Strix nebulosa*) nests.

RANDALL A. SMITH, U.S.D.A. Forest Service, Stanislaus National Forest, Groveland Ranger District, P.O. Box 100, Groveland, California 95321. Phone: 507-551-7000.

In September of 1984 ten artificial nest structures were installed in the vicinity of the Anderson Meadow Complex on the Groveland Ranger District of the Stanislaus National Forest. These structures were created by logging large snags, leaving a central hollow (30 to 35 inches dia) and carving a nest bowl, including a water drain hole. The nest bowl was filled with hanging log debris to provide nest litter. In mid-April one of the structures was occupied by a Great Gray Owl, and two chicks hatched. One chick survived to fledging.

Habitat management for Spotted Owls (*Strix occidentalis*).

DAVID W. SMITH, U.S.D.A. Forest Service, Six Rivers National Forest, 507 E. Street, Eureka, California 95501. Phone: 707-842-1751. Patricia M. Kelsey, Humboldt State University, Arcata, California 95521. Phone: 707-842-3477. and George Lortie, U.S.D.A. Forest Service, Six Rivers National Forest, 507 E. Street, Eureka, California 95501. Phone: 707-842-1751.

Research was conducted to determine habitat use for 10 Spotted Owls (*Strix occidentalis*) in northwestern California. Information provided by radio-telemetry and habitat measurements was used to determine key habitat characteristics which need to be considered when managing habitat for Spotted Owls. Habitat management for Spotted Owls may include the development of timber management prescriptions. Objectives of silvicultural prescriptions are to create or maintain characteristics of habitats important to Spotted Owls for foraging, roosting, and nesting. Key habitat characteristics included a multi-layered stand structure, dense canopy, and a diverse canopy. The effects of a variety of silvicultural options on the availability of habitat for foraging, roosting, and nesting by owls are suggested; mitigation measures are suggested. Optimal prescriptions include retention of large (150+ years) trees and retention or retention of forest and nest groves, dead and down components, and large snags.

The response of Asio owls to changes in vole numbers.

ANDY VILLAGE (Institute of Terrestrial Ecology, Monks Wood Experimental Station, Abbots Ripton, Huntingdon, Cambs. PE17 2LS, United Kingdom. Phone: (04873) 381).

The breeding density and performance of Long-eared owls (Asio otus) were recorded over four years in a large area of recently planted conifers in south Scotland. Numbers and territory size of Short-eared Owls (Asio flammeus) also were measured at the same time using roadside counts. Both species showed strong responses to changes in short-tailed vole (Microtus agrestis) numbers. Long-eared owls bred at higher densities, earlier, and more successfully when voles were abundant, than when they were scarce. Short-eared Owls were most abundant in those habitats that held the most voles, and numbers in young plantations declined sharply during a vole crash in 1977. Recoveries and sightings of marked Short-eared owls suggested they may have dispersed widely during the population decline.

Factors influencing the distribution of the Burrowing Owl (Athene cunicularia) in Cape Coral, Florida.

TED WESEMANN (Appalachian State University, Boone, North Carolina 28608. Phone: 704-262-3025).

The Burrowing Owl has traditionally inhabited the prairies in south and central Florida. Four factors possibly influencing owl distribution were studied: building density (availability of habitat), prey abundance, soil composition, and vegetation height. Range expansion has been a result of land clearing for development and agriculture. Modified habitats, such as airports, golf courses, and schoolyards, are readily utilized. Vegetation height alone may be a limiting factor. No correlation was found between soil composition and owl distribution, but a preference for sandy sites was noted. Higher numbers of owls were found in high building density areas. These areas also had a higher concentration of insects which may be more visible due to lighting.

Bioenergetics of the Long-eared Owl (Asio otus).

HARRY WIJNANDTS (Zoological Laboratory, University of Groningen, Kerklaan 30, 9750 AA Haren, The Netherlands).

A combined laboratory and field study of food intake and metabolic rate in the Long-eared Owl was carried out in the Netherlands. Metabolized energy in free-living owls averaged 275 kJ per day, but was slightly lower in winter. This level, about 2.5x BMR, is at the lower end of the range delimited by field studies for other raptors. Long-eared and other owls show BMR values about 75% of the general nonpasserine level. Under standardized cage conditions a similar economy in energy intake was found for the Long-eared Owl and 12 species of other Strigiformes as indicated by literature data. The discrepancy between energy expenditure of the Long-eared (and probably other owls, too) compared to many other kinds of birds will be discussed, and it will be emphasized that the superior insulation in this species largely explains the discrepancy.

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Dear Colleague:

Enclosed is a complete set of abstracts from the 1985 Raptor Research Foundation Symposium on the Management of Birds of Prey. The Bureau was a principal sponsor of this important meeting, which was attended by 858 people from 34 countries. About 385 professional papers were presented.

Please note that considerable effort was made to get complete addresses and phone numbers of those who presented papers. You will find these at the beginning of each abstract. If a particular abstract is of interest, feel free to contact the author(s).

Only portions of the symposium will eventually be published. These include the Peregrine Falcon papers, those on raptor reintroduction, and the entire World Working Group session. Others have been encouraged to submit papers to the journal Raptor Research. In many cases, however, personal contacts will be the only way to get more information.

I also wish to take this opportunity to remind you about the Raptor Management Information System, a collection of nearly 3,900 papers dealing with raptor management and human impacts on raptors. This system is housed at the California State Office and is accessible on the Honeywell DPS-8 or through this office. Please let us know if you need more information on this system or would like us to do a search for you.

Sincerely,

Richard R. Olendorff

Richard R. Olendorff
Endangered Species Coordinator

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